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VOL. 296. 110th YEAR. LONDON, NOVEMBER 26, 1958 No 4976 PRICE 1/6

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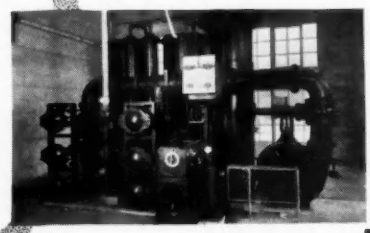

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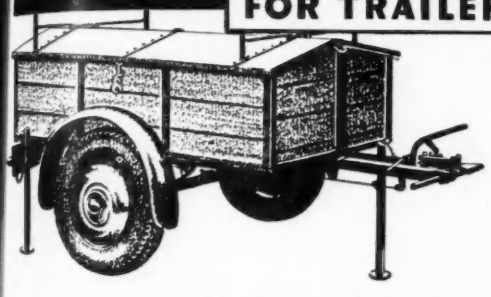

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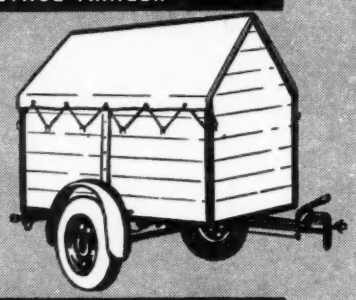

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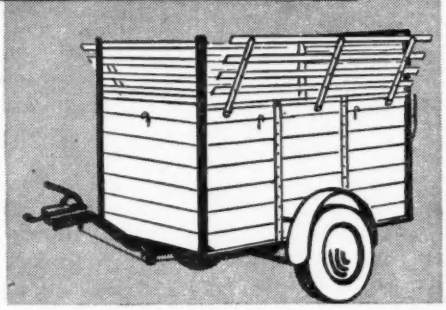

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Gas Journal

VOL. 296 NO. 4976 NOVEMBER 26, 1958

110TH YEAR

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CONTENTS

EDITORIAL COMMENT

A New Technological Award - - - - - - - - 375
Mr. Brewer: Retrospect and Prospect - - - - - - 376

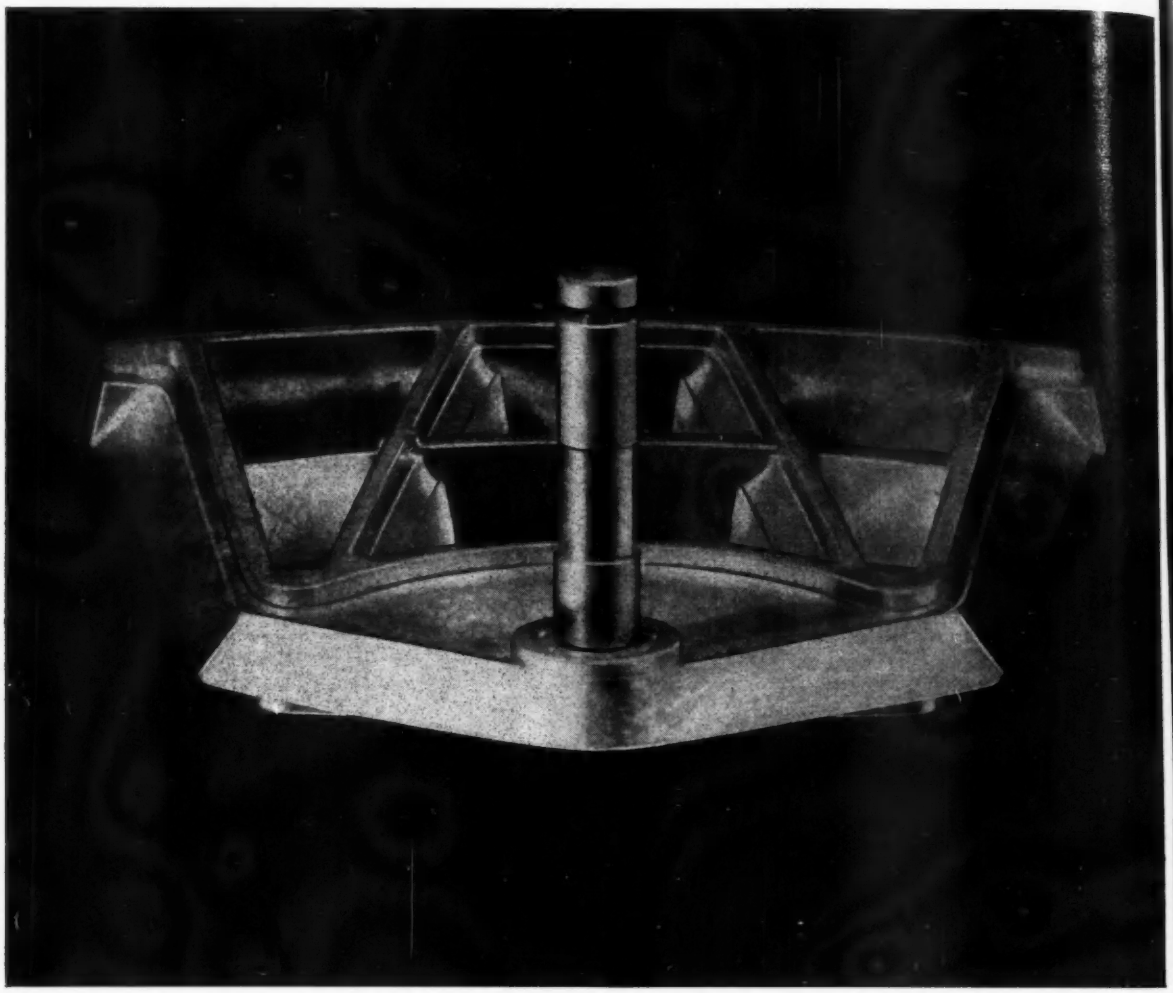
24th AUTUMN RESEARCH MEETING I.G.E.

The Meeting - - - - - - - - - - 377
The Luncheon - - - - - - - - - - 379
Joint Refractories Committee - - - - - - - - 380
Gas Education Committee - - - - - - - - 384
Gas Council Research Scholarships - - - - - - - 386
Chairman's Technical Committee - - - - - - - 387
Prospective Development—and the Present Situation—of Gas in the U.S.S.R. By M. Sidorenko - - - - - - 391
Refractories Research and the Gas Industry. By A. T. Green - 393

NEWS OF CURRENT EVENTS

Personal - - - - - - - - - - - 378
Diary - - - - - - - - - - - - 378
Gas Board Gains Advantage in Fight for Lurgi Site - - - 399
Gas in House No. 3 Mill. - - - - - - - - 399
Industrial Safety in Birmingham - - - - - - - 399
British Empire Medallists - - - - - - - - 400
We Must Push Domestic Coke Sales, says W.M.G.B. Deputy Chairman - - - - - - - - - - 400
Bid to Cut Cost of Gas Heating in Notts. Schools - - - 400
Simon-Carves Ltd., Completes Take-over Deal - - - - 400
Northern Juniors see Redheugh Onia-Gegi Plants - - - 400

PUBLISHERS' NOTICE See page 358, November 19, 1958



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Gas Journal

VOLUME 296. No. 4976 NOVEMBER 26, 1958. 110th YEAR

A New Technological Award

WE have always held that nothing gives a clearer indication of the technical temperature of the industry than the programme of Autumn Research Meeting of the Institution. Certainly the 24th in the series, held last week, revealed three major interests of the industry today. Most prominent perhaps was the group of papers devoted to various aspects of industrial utilisation; no less significant were the papers dealing with sulphur removal and the progress reports on new methods of gas production. In fact it appears to us that the planning of these meetings have been substantially 'tightened' in order to tailor them to the needs of the moment.

As on previous occasions Church House lent to the proceedings a somewhat devotional atmosphere which was nicely accentuated by the President's reverent chairmanship. Seriously though, Mr. E. M. Edwards has good reason to feel proud of having officiated at such a memorable meeting, one which amply sustained the high technical standard which we have come to associate with these conferences. And reference might also be made to the presence of a welcome visitor from Moscow, Mr. M. V. Sidorenko, Deputy Director of the Central Department for the Gas Industry attached to the Council of Ministers of the U.S.S.R. Mr. Siderenko, who is the first Russian to attend such a meeting since his country became represented in the International Gas Union, gave an address which is reported elsewhere in this issue.

One item which particularly interested us was the discussion on the 35th Report of the Gas Education Committee (the presentation of which was one of the longest we can remember). The discussion was opened by Mr. J. H. Dyde, Deputy Chairman of the Eastern Gas Board, who might be described as the gas industry's arch educationalist, and his subject was the introduction of the Diploma of Technology. We have not previously referred to this important matter and in the circumstances we can hardly do better than quote Mr. Dyde's remarks.

The National Council for Technological Awards was set up by the Minister of Education in July, 1955, to implement the recommendations of the National Advisory Council on Education for Industry and Commerce, which provided for the making of awards to successful students of technology in technical colleges. The White Paper on Technical Education presented to Parliament the following year made it abundantly clear that this country could not produce the technologists in the number we needed for our expanding industry solely by expanding the University provision, but that the number of sandwich and full-time courses at technical colleges must also be greatly increased. It was felt at that time that the national awards available for advanced technological courses in technical colleges did not satisfy present needs; either the standard was not high enough or external control imposed on syllabuses a rigidity out of keeping with modern technological developments.

The new National Council, with its two Boards of Studies, one in engineering and one in technologies other than engineering, held its first meeting in December, 1955, and by May, 1956, produced its first memorandum on the recognition of courses in Technical Colleges leading to the Diploma in Technology—Dip.Tech.(Eng.) for engineering, and Dip.Tech. for technologies other than engineering. In the ensuing three months the Boards of Studies set up subject panels to deal with individual technologies. Each panel comprises Council members from technical college staffs, members of the Council associated with professional Institutions—like Mr. Dyde as the I.G.E. representative—and industry and a certain number of co-opted members for certain specialist subjects, and also one H.M.I. as an assessor. Significantly, gas engineering has been grouped in the same panel as chemical engineering, which comprises Mr. J. A. Oriel, Past President of the Institution of Chemical Engineers, who is Chairman, two Principals of Technical Colleges, Dr. F. Briers and Dr. J. E. Garside, Mr. G. U. Hopton, a research chemist of the North Thames Gas Board, Mr. F. Caunce, the

H.M.I. Assessor, who is well known to the gas industry, and of course Mr. Dyde.

Recognition of a course has not been lightly given, for the Council is extremely jealous of preserving the high standard which it has set. The standard of this Dip.Tech. award is the equivalent of a honours degree of a British University, and will no doubt be accepted as a national currency of that standard in industry.

The first application for the recognition of courses was received in August, 1956, and others followed in quick succession. The November figures show that 55 courses are in progress at 17 technical colleges, 28 of them for Dip.Tech.(Eng.) and 27 for other technologies. There are 1,786 students at present enrolled, about half of them in their first year. Eleven courses are full-time and 44 are on the sandwich system, of not less than four years, with academic work integrated with work in industry. Of the 28 engineering technology courses, ten are electrical, ten in mechanical and production engineering, three in aeronautical engineering, two in chemical engineering, two in civil engineering and one in instrument and control engineering. There is no gas engineering course so far.

Mr. Dyde feels that participation by the gas industry in this new system should now be earnestly considered. At the time the sandwich courses were considered commencing with the entry standard corresponding to the Ordinary National Certificate of Education, it was felt by area boards that an additional three years was sufficient, as a period for which they could readily release their students. The Institution itself had under consideration the revision of its syllabus for the Associate Membership examination so that in the light of present trends in the functional organisation of the industry a greater degree of specialisation could be introduced.

In considering its plans for the future, the Institution may well wish to link its ideas with those of the National Council so that a common aim may be achieved. If the industry wishes to participate directly in this new scheme of education, there must be consultation between the industry and a technical college which has the buildings, facilities, equipment and staff appropriate to the needs of the Dip.Tech. course. The Council feel very strongly that participation in any project teaches a student to plan a piece of work and to carry it through to a successful conclusion, as well as serving as a further link between his industrial training and the subjects he has studied in his academic course. The college should be able to provide for liberal studies, for the courses for the Dip.Tech. not only require an approved standard in a technology but must also show a breadth of outlook and content reflecting a combination of liberal studies and informal activities.

Obviously colleges where there are existing sandwich courses must be considered first, but it is not merely a question of adding another year to the present sandwich courses and putting in a few extra subjects. That will not pass the Council. The whole content of the courses must be examined, and it is clear that the industry would have to provide an intake of at least 12 students a year. To deal with such a specialised subject, the teaching staff must come from the gas industry, and the industry must also provide facilities for the technical college staff to visit students during their training period within the industry.

'We have heard a good deal about our industry's plans for the future, with much larger capacity production plant envisaged and so on,' said Mr. Dyde. 'I do not think we need masses of technologists, but we need them of first quality. On the production side, their basic training must lean more than hitherto towards the chemical engineering side. A first course of the Dip.Tech.(Eng.) in production could meet this situation. The time is just about right to make a start; distribution and utilisation could follow.'

Mr. Brewer: Retrospect and Prospect

THE publication last month of the Gas Council's annual report was a reminder that this would be the last report to be prepared by Mr. F. G. Brewer, who retired from the Secretaryship of the Council at the end of September. It was in fact the ninth report for which he had been responsible, and some thought it the best. Inevitably, we suppose, there is a tendency to think of Mr. Brewer in this rather official capacity, and indeed the dry facts of his career have been widely reported. But it is more interesting, and certainly more rewarding, to look for the man behind the job.

For example, one might look back before 1934 (the date he 'went into gas') when Mr. Brewer was a journalist on the staff of *The Times*. Those days were recalled by Mr. Alan Pitt-Robins, former News Editor of *The Times*, who described Mr. Brewer as 'much more than a colleague—a close personal friend.' As a Parliamentary reporter at that time, Mr. Pitt-Robins did not have his own office at *The Times*—most of the week he was, of course, in the House. When he wanted to write copy at the office of the newspaper, he used to go to the office of his brother, who was at that time Day Editor, and who was in the same office as Mr. Brewer. 'They used to take me in like a lost sheep,' Mr. Pitt-Robins reminisced.

Mr. Brewer's main duty at *The Times* was to look after the correspondence columns. Apart from sifting through the hundreds of letters received each day in order to select those to be recommended to the editor for publication, the work also entailed spotting bogus letters, obtaining the approval of correspondents for cuts and alterations and, of course, dealing with the occasional reader who was outraged because his or her letter had not been published. Despite the pitfalls inherent in the task, Mr. Brewer must have made a pretty good job of it, for Mr. Pitt-Robins could recall no instance of a failure on his part to spot a bogus letter—'he seemed to have a knack of spotting the spurious ones'—or to pacify a reader whose literary masterpiece had failed to appear to the readers' letters columns.

At the same time, Mr. Brewer was popular with other members of the staff—despite what might have been looked upon by fellow journalists as a somewhat 'murky' past (albeit for a short period) in the secretaries' office of the Board of Inland Revenue. 'In fact, he was a first-class

trouper, and it was a great shock to his colleagues when he decided to go into commerce,' said Mr. Pitt-Robins.

In the dark days of the war, when he was Secretary of the South Metropolitan undertaking, Mr. Brewer was also a major in command of 'A' Company of the 49th Battalion, Home Guard. A colleague of those days, Mr. A. C. Higgins, now Assistant Secretary of the Institution of Gas Engineers, recalls that Home Guard duty once cost Mr. Brewer his Sunday joint. It happened one Whitsun. Each night Home Guard units provided a duty officer, N.C.O., and half a dozen men to man two pillboxes beside the Thames from which reports of parachute mines seen falling into the river were made to the Admiralty.

The practice was that at holiday weekends, the rations for both the Sunday and Monday night duty personnel would be left in the refrigerator—including two joints, one for each night. On this occasion, however, one large joint instead of two small ones had been left for the Sunday and Monday night 'crews.' Mr. Higgins' detachment, on duty on the Sunday, found the joint, decided that the suppliers were being particularly generous—and ate the lot. When Mr. Brewer came on duty the next day his supper consisted of potatoes and greens. 'Ever since, I have occasionally been pointed out by Mr. Brewer as the man who once pinched his joint,' said Mr. Higgins.

One difficulty experienced by his fellow H.G. officers was a system of holding conferences following Sunday morning Home Guard exercises. Mr. Brewer organised these conferences to discuss the lessons which had been learned from the morning's exercise. A bachelor, he had some difficulty in understanding his fellow officers' explanations that it was most important that they should be allowed to get away in good time in order to avoid unfortunate consequences when they arrived home to face their wives and spoiled lunches.

Perhaps Mr. Brewer will appreciate their point of view very soon, for next month he will be joining the ranks of married men when his own marriage—to Miss P. M. Barnes, who was his personal secretary at the Gas Council—takes place. It seems to us that his qualities of courtesy and consideration for others auger well for matrimonial bliss. We wish him every happiness.

The I.G.E.'s 24th

AUTUMN RESEARCH MEETING

THE 24th Autumn Research Meeting of the Institution of Gas Engineers was held at Church House, Westminster, on November 18 and 19, under the Presidency of Mr. E. M. Edwards.

Overseas visitors, who were welcomed by the President, included, from Belgium, M. R. H. Touwaide, General Secretary of the International Gas Union, and M. Mayfroot; from Denmark, Mr. N. V. Steenstrup; from France, M. A. Lihrmann, M. J. Brullé, and M. H. Caudry; from Germany, Dipl. Ing. J. Karrner and Dr. Ing. I. Lorenz; from Italy, Dott. Ing. E. Bertini, Dr. A. Bohm, and Prof. C. Padovani; from the Netherlands, Mr. J. H. Steinkamp and Ir. J. G. de Voogd; from Switzerland, M. I. Telecki; and from the U.S.S.R., Mr. M. V. Sidorenko and Mr. Y. P. Blinov. The President had a special word for Mr. Sidorenko because this was the first occasion on which they had had the pleasure of the company of a representative from the U.S.S.R. since their colleagues in that country became members of the International Gas Union.

New Honorary Member

The President also made particular reference to a new Honorary Member, Sir Charles Ellis. 'This is an award only granted to persons eminent in science, combined with experience in pursuits connected with the gas industry,' he said. 'This honour accorded to Sir Charles is richly deserved, and we all hope that he will live long to grace our company and to enrich our deliberations.' He went on to remark: 'In May last a similar honour was accorded to our good friend Mr. R. H. Touwaide, General Secretary of the International Gas Union and the Belgian Gas Association. As he was not able to be present at the meeting in May, I take this, the first opportunity of saying how pleased we all are that he has become an Honorary Member of this Institution. May he continue for many years to come to give to us his most valuable counsel in the affairs of the industry which he has served so well for such a long period.'

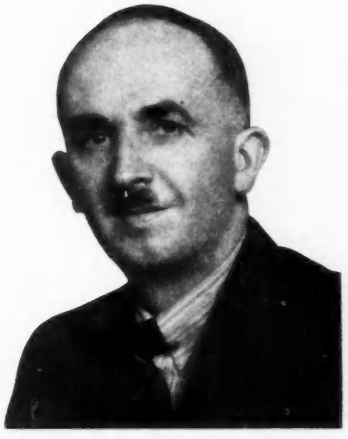
There followed the 49th Report of the Joint Refractories Research Committee, and the 35th Report of the Gas Education Committee, the discussions on which are reported elsewhere in this issue.

Presentation of awards

The next item on the agenda was the Presentation of Awards for 1958, when the President presented the Diploma in Gas Engineering (Supply) for 1958 to Herbert Guy Willes (London), Mr. C. Holmes Hunt presented the Charles Hunt Memorial Medal for 1958 to John Stanley Goode (Birmingham), Associate Membership Examination—Gas Engineering (Manufacture) and the President presented the James Archibald Maclay Memorial Prizes for 1958 to Frederick Charles Carter (London), Gas Technology (Supply); and Francis McDonagh (Blantyre), Gas Salesmanship and Consumer Service.

The first morning's business concluded with the 19th Report of the Chairmen's Technical Committee, reported on a later page.

Three complementary papers on sulphur removal occupied one of the afternoon sessions. These were 'The Influence of Frequency of Rotation on the Behaviour of Oxide Purifiers,' by J. M. Brown, R. J. S. Thompson and S. C. Porter, 'Removal of Hydrogen Sulphide from Gas Using an Organic Oxygen Carrier,' by J. E. Davis, J. E. Mills and C. Ryder, and 'Liquid Reagents for the Final Removal of Hydrogen Sulphide from Gases,' by W. B. S. Newling.



The President, Mr. E. M. Edwards.

Meanwhile, in the other hall, three industrial papers were presented: 'Immersion Tube Heating of Aqueous Liquids,' by E. A. K. Patrick and E. Thornton, 'The Design of Air Blast Tunnel Burners,' by W. E. Francis, and 'Combustion Noise,' by J. K. Kilham and T. J. B. Smith.

Current technical development

The following morning three papers which reflected current technical development in gas production were given in one hall—'Experiments with a Slagging Pressure Gasifier,' by D. Hebden and R. F. Edge, 'Experiences with Refinery Gas at Southampton,' by W. F. Thorne, R. K. Harrison and J. R. Fairman, and 'The Hydrogenation of Light Distillate with Reference to the Production of By-product Aromatic Hydrocarbons,' by L. A. Moignard and K. D. Stewart—while three, wholly unrelated, papers were presented in the other hall. These were Part II of 'An Investigation into the Com-

Concluded overleaf

Personal

MR. W. J. BAKER, Member of the South Western Gas Board, is to devote most of his time to the co-ordination of all functions and specialist sections of the Board's organisational development programme under which the elimination of divisions has now been achieved, thereby establishing a two-tier functional organisation and shortening the lines of responsibility and communication as between management in the field and area headquarters. To assist the Board Member throughout the area, Messrs. T. L. TALLENTIRE, W. B. CLARIDGE, J. D. BUTLER and J. W. DEAN have been appointed as Regional Managers for Cheltenham, Gloucester and Bath; Swindon; Bristol, Weston-super-mare, Taunton and Yeovil; and Devon and Cornwall respectively. The Chief Engineer will be responsible for distribution, as well as production engineering. MR. T. N. DENT, the Area Development Manager, has been appointed a Principal Executive, with full responsibility for all general consumer service matters, including coke marketing, transport and industrial gas, but excluding gas distribution. MR. T. W. JACKSON has been appointed Area Distribution Engineer, on the staff of the Chief Engineer. Additionally, two new District Managers have been appointed—MR. M. R. WEBB, previously Commercial Assistant, Cheltenham/Gloucester Division, to Gloucester District, taking over from MR. W. CHARD; and MR. W. FREER, previously Commercial Assistant, Torquay/Exeter Division, to Weston-super-Mare District. MR. T. A. NICHOLSON has taken over Taunton District, on leaving Weston-super-Mare. MR. CHARD, previously Gloucester District Engineer and Manager, has been seconded to special duties. MR. F. G. CRAXFORD has been transferred to area headquarters, on the staff of the Area Development Manager, with special responsibility in connection with meter development, installation and repairs.

MR. JOHN G. WILSON, General Sales Manager of Universal Metal Products, Ltd., has been elected to the Board of the Company. MR. J. KENYON, Sales Manager, Plastics Division, has been appointed General Manager of this Division.

MR. H. J. STARNS, Manager of the Cardiff office of the Staveley Iron and Chemical Co., Ltd., retires on December 31 after 27 years with the Company. His successor is Mr. R. Meyrick.

MR. R. L. LAING, who has been Manager of the Brechin gasworks since 1929, is to retire.

Women's Gas Federation

New branches of the Women's Gas Federation in Scotland have been formed in Alloa and Paisley.

A Southern Gas Board team has won the annual public road safety quiz competition of the Southampton Accident Prevention Council. In the final they scored 94 marks to 61 against the Corporation Transport Department. The Mayor of Southampton, Alderman R. R. H. Hammond, said: 'I would like to pay tribute to the drivers of heavy vehicles on our roads. These men were not concerned with speed and generally were a great example.' Pictured above, the Mayor presents the cup to the team, who are (left to right) Mr. F. Hornong, Mr. L. R. Reeves (captain), Mr. H. W. Davies and Mr. D. Seaborne.

Diary of Forthcoming Events

November 27.—North Thames G.C.C.: Westminster City Hall, Charing Cross Road, London, W.C.2.

November 27.—SOCIETY OF CHEMICAL INDUSTRY: Houldsworth School of Applied Science, the University, Leeds 2. Fourth Hodsman Memorial Lecture on 'Trade Effluents,' by H. Hollings. 7 p.m.

November 28.—JUNIOR INSTITUTION OF ENGINEERS: Pepys House, 14, Rochester Row, Westminster, S.W.1. Annual General Meeting. 7 p.m.

December 2.—SOUTH EASTERN G.C.C.: Caxton Hall, Westminster. Council Meeting at 11 a.m.

December 3. — INSTITUTE OF FUEL: Great George Street, London, S.W.1. 'The Work of the British Coke Research Association,' by G. W. Lee. 5.30 p.m. All I.G.E. members may attend.

December 3.—NORTH OF ENGLAND SECTION, I.G.E.: Northern Gas Board, Market Street, Newcastle-upon-Tyne. 'Underground Corrosion and Cathodic Protection of Gas Pipelines and Equipment,' by J. S. Gerrard. 2.30 p.m.

December 3.—JUNIOR INSTITUTION OF ENGINEERS, MIDLAND SECTION: James Watt Memorial Institute, Great Charles Street, Birmingham. 'Factory Heating and Ventilating,' by J. F. Elsworth. 7 p.m.

December 3.—NORTH WALES SECTION, WALES AND MON. JUNIORS: Prestatyn Gas Showroom. 'Cash Control and Collection,' by F. W. Stobart. 3 p.m.

December 3.—SOUTHERN G.C.C.: City Council Chambers, 1, Clarence Parade, Southsea. 11 a.m.

December 3.—EASTERN JUNIORS: Tottenham. Alternative visits to either Keith Blackman Ltd., or Ponders End works during morning, followed by short paper meeting in afternoon.

December 4.—SOUTH WESTERN G.C.C.: Taunton. Council Meeting at 11 a.m.

December 4.—COMBUSTION ENGINEERING ASSOCIATION, NORTHERN REGION: Hotel Metropole, Leeds. Brains Trust: 'The Utilisation of Low Grade Fuels.' 2.30 p.m.

December 5.—LONDON AND SOUTHERN JUNIORS: Caxton Hall. Annual Reception and Dance.

December 5.—MANCHESTER AND DISTRICT SECTION, I.G.E.: Houldsworth School of Applied Science, University of Leeds. 'Fuel Research in the Changing Scene,' by Dr. D. T. A. Townend, of B.C.U.R.A. 11 a.m.

AUTUMN RESEARCH MEETING

(*From previous page*)

position of Ammoniacal Liquor: A Survey of the Effluents Produced in the Gas and Coking Industries,' by L. Barker and N. W. Hollingworth, 'Further Experiments with Shared and Individual Flues for Gas Appliances,' by W. J. Bennett, K. J. D. Brady and E. W. G. Dance, and 'Chromatographic Gas Analysis,' by G. R. Boreham and F. A. Marhoff.

In the afternoon, after the presentation of a Report on the Gas Council Research Scholarships, four further papers were presented: 'The Measurement of Gas Stream Temperatures in Industrial Appliances—A Suction Pyrometer for Temperatures above 1,100°C,' by P. G. Atkinson and J. R. Hargreaves, 'Some Notes on Energy Transfer from Flames,' by G. Dixon-Lewis, 'Refractories Research and the Gas Industry,' by A. T. Green, and 'The Odour and Odorisation of Gas,' by K. A. Deadman and J. A. Prigg.

Finally an omnibus vote of thanks to all concerned was proposed by Mr A. McDonald, seconded by Mr. M. Sinclair Gaskill.

THE RESEARCH LUNCHEON

'The gas industry knows where it is going and is determined to get there'

'THERE is no doubt that the industry has its eye on the future,' said **Sir Harry W. Melville,** K.C.B., Secretary of the Department of Scientific and Industrial Research, in his reply to the toast of 'The Guests' at the Autumn Research Luncheon at the Savoy Hotel. 'It knows where it is going and it is determined to get there.'

Referring to the changing pattern of the gas industry and of gasworks, Sir Harry recalled the last visit he had paid to a works. It had conveyed an impression of a modern chemical engineering installation. There was mechanical handling of all kinds, the laboratories were equipped with the most expensive and elaborate apparatus, electric light was everywhere, and it was obvious that electric motors did all the moving about of the coal and operating the mechanism. Such changes had come about, not naturally, but to a large extent due to the efforts of the Institution. Had it not been for those people in industry who were forward-minded and could see the advantages of using these new tools, this transformation would never have taken place. These men had had the vision that techniques developed in other parts of science could be employed with great effect in the industry, and he was sure that the present higher efficiency in every respect was due in no small measure to such pioneers.

Collaboration

'To some extent,' he continued, 'it may be that the transformation has been due to a certain amount of healthy competition. I do not think it has been wasteful competition, and one of the best examples is contained in one of the papers that is being presented to this meeting—a very interesting paper on the use of refinery gas to supplement the supply of coal gas. . . Here we have an active collaboration with another industry altogether, an active collaboration which is highly desirable if one remembers that the value of crude petroleum imported into this country is no less than £300 mill. a year. That is an awful lot of money, and the fact that every product of a modern oil refinery finds its way into some useful purpose in this country is a tribute not only to the oil industry, but also to your own industry, which had the sense to see that something could be utilised from that product.

'The same thing applies to the importation of liquid methane. This is a technical experiment of great complexity and considerable difficulty. Of course, one must take a wider view of the matter than merely a national one. These enormous supplies of methane are available in different parts of the world, and the fact that this British industry has the sense to see that those supplies can make some contribution to the peak load in this country is a very far forward-seeing policy which deserves every encouragement.

'This competitive spirit is also present as the driving force in the determination to use to the best possible advantage the coal which is available in this country. The low-grade refined coal, which is available in large quantities, has had to be used by the electrical industry for many years—in fact it has been forced to use it. They have found ways of using it effectively, and now it is the turn of the gas industry to do likewise. Therefore I was particularly interested in reading the paper on the experiments at Solihull on the technical problems involved in the production of a pressurised complete gasifier. I very much hope, as a matter of scientific and technical interest, that the people engaged in this project bring it to a satisfactory conclusion. To have a British slagging high-temperature, high-pressure gasifying apparatus on an economical basis would reflect great credit upon those involved in this research. I hope that not only will the technical facilities be made available to these people who are engaged in the project, but that the finance also will be forthcoming from the Gas Council to carry it to a successful conclusion.

'The other thing that struck me about the meeting was the great variety of the papers. One feature of particular importance was the fact that those engaged in the industry again went outside their industry to look for technical developments elsewhere which might be adopted and usefully employed in the industry. For example, there is a paper on the problems in gas chromatography in the industry. That is a technique which now has been going for a number of years. Its application to the analysis of paraffinic hydrocarbon mixtures is comparatively simple and works out extremely well. To use the same technique for the analysis of town gas is, however, a much more difficult operation because of the presence of methane and other qualities of that kind. The paper, therefore, has followed up that idea and examined these problems and, I hope, has produced a modification of the technique which is specially applicable in this field.'

Most difficult

Other very intriguing papers dealt with trying to prove the quantitative measurement of odour on a national basis —that must be about the most difficult of any scientific problem—and the high pressure hydrogenation of paraffinic hydrocarbons to chemically pure benzene.

Speaking of education, Sir Harry said that the Institution had a vital part to play. 'It is now firmly established that the State shall play its part in education, but the Institution can be complementary, and even supplementary, in this function, because it can see in this industry the places where its resources, although they are limited, can be most effectively placed and, therefore, make a contribution to the whole which would be quite impossible for any State scheme.'

The guests

In proposing the toast, the **President** had welcomed in particular the overseas visitors, such representatives of the Ministry of Power as Mr. P. D. Proctor, the newly-appointed Permanent Secretary, Mr. Martin Flett, Deputy Secretary, and Mr. Owen Francis, Under-Secretary, Gas Division, and Mr. E. J. C. Dixon, Controller of the Gas Standards Branch, representatives of other Ministries such as Mr. T. W. McCullough, Chief Inspector of Factories, Mr. S. J. Emerson, Senior Electrical Inspector, Ministry of Labour and National Service, Mr. J. F. Embling, Assistant Secretary, Ministry of Education, and Mr. J. S. Carter, Chief Alkali Inspector, Ministry of Housing and Local Government, Professor A. L. Roberts, Livesey Professor, University of Leeds, Sir Harold Hartley, Sir Robert Robinson, a prominent member of the Gas Council Research Committee, Sir Henry Self, Chairman of the Electricity Council, Sir Josiah Eccles, Deputy Chairman (Operations), Electricity Council, and Mr. Richard Fort, M.P., Chairman of the Parliamentary and Scientific Committee.

Referring to the increasing tempo of research activities by the gas industry in Great Britain, the President said that an atmosphere of vigorous activity permeated the industry. He spoke of new methods and new materials, which might make gas available over a wide field and at lower prices. While gas was, even under present conditions, more than competitive with other fuels for many uses, the improvements visualised should result in lower costs and should open the door to widely increased markets.

'It should be remembered that the tremendous expansion of the gas industry in the United States during the last decade is not due to the availability of large quantities of natural gas as such; it is really due to the low price at which gas is sold by comparison with other fuels. There lies the challenge, and there is every indication that it will be met in this country.

Mr. R. S. Snelling, O.B.E., Deputy Chairman, Wales Gas Board, proposed the toast 'The President of the Institution of Gas Engineers,' and the President briefly responded.

FORTY-NINTH REPORT OF THE

Joint Refractories Committee

THREE of the papers included in this Report are direct consequences of a panel set up pursuant to a conference held two years ago to review the refractories research carried out for the carbonising industries. Mr. J. Laming sets out the present position of investigations of the flaking in gas retorts and the temperature surveys of (particularly) continuous vertical retorts, while Mr. L. Sabiston and Mr. J. F. Clements give an account of the first survey of scurfing practice. The Report includes a number of written comments on the temperature surveys; these comments are contributed by seven individual engineers, one of them a refractories manufacturer, and two area gas boards.

A fourth paper discusses a preliminary investigation of failures of refractories in oil-gas plants (by Mr. Sabiston), while the progress reports of other investigations now in hand cover, briefly, field trials on flaking and the effect of iron spots, the durability of refractories in continuous vertical retorts, a comparison of the performances of French silica and British siliceous materials in CVRs, some laboratory experiments on the deposition and burning of scurf, experiments on the glazing of sicila bricks, the co-operative study of the refractoriness-under-load test, and some further experiments in the laboratory on spalling.

'Flaking' and 'spalling'

Mr. Laming emphasises the importance of the uniform and accurate use of the term 'flaking,' as distinct from 'spalling.' 'Flakes of refractory, varying in thickness from less than $\frac{1}{32}$ in. to about $\frac{1}{2}$ in. or more, become detached from the carbonising face of the retort during scurfing . . . Flaking is a type of deterioration primarily affecting continuous vertical retorts . . . its appearance in other systems is rare.' The term 'spalling' should be confined to the 'damage to the refractory material that may occur as the result of thermal shock alone.' The temperature of the retort wall in the flaking zone of a CVR never falls below 600°C., above which the thermal expansion characteristics of silica and siliceous materials make it impossible for spalling to occur.

Two interesting observations are made. Flaking does not occur appreciably in Scotland, suggesting a relation between the incidence of flaking and the swelling number of the coal carbonised. Haffner has suggested a relation between the 'flaking index,' (cu. in. of brickwork lost per 1,000 tons of coal) and the CV of the made gas. As to distribution within the retort, it is noted that in retorts in settings where the products of combustion of the fuel gas travel upwards (upwardly heated retorts and those set in horizontal combustion chambers) 'flaking is not so localised as in downwardly heated systems and, other things being equal, does not penetrate to so great a depth.' This difference is probably related to differences in temperature distribution and/or temperature gradient through the retort wall.

Historical review

Mr. Laming proceeds to a historical review of the literature on flaking, beginning with a paper in 1924, some ten years after siliceous and silica materials were first used in the construction of retorts. Two theories emerge. The differential expansion theory—which enunciates that the difference between the coefficient of expansion of the scurf and that of the retort material is sufficient to account for the removal of flakes by the stresses set up during temperature changes—and the adhesion and traction theory which postulates that the curling of firmly adhering scurf could pull off the flakes during scurfing. 'The two theories are not mutually exclusive.'

The author and Dr. Rigby have shown in laboratory experiments that 'carbon deposition could produce a layer on the surface of the refractory having a coefficient of thermal expansion different from that of the underlying brick.' They also showed that carbon penetration into the refractory is an important factor—'flaking could be produced in the laboratory if the transition zone from heavily impregnated surface to unaffected brick were narrow. . . It was concluded therefore that any factor that increased the ratio of surface carbon to pore carbon might be expected to increase the flaking tendency . . . in a gas retort.' The implication is that 'flaking may actually be initiated before the scurfing period'—an important new concept. Mr. Laming develops the idea in his discussion of results of the investigations so far.

Recommendations

He concludes with a number of recommendations to minimise flaking. (1) Temperature and temperature gradient in the flaking zone should be kept as low as is consistent with carbonising requirements, particularly during the first few hours of the working period; (2) maintain smooth travel of the charge; (3) avoid steep rises in the temperature of the flaking zone—this can be achieved by carefully controlled downward scurfing; (4) 'The refractory in the flaking zone should have low permeability and porosity and high mechanical strength at the working temperature.'

At the conference referred to above, one item considered to be of very great importance was the formulation of a code of practice for scurfing. It was evident that the gas engineer looked upon scurfing as a necessary evil. As a basis for the preliminary survey reported upon by Messrs. Sabiston and Clements a questionnaire was drawn up (with 30 questions) and circulated to 'sixteen works using six types of flue system in five areas'—selected to give a wide coverage of coals and calorific values. The several works were visited by a member of the panel in collaboration with whom the answers were drawn up. The key answers are tabulated in the paper.

'Bearing in mind that this preliminary survey covers only a small number of works, it can be stated that, on the observations made and the statements of the works personnel, the method of removing scurf does not appear to influence the severity of flaking.' At the same time attention is drawn to the fact that retort life depends to some extent on the procedure adopted for scurfing.

No correlation

With regard to details it is obvious that no clear relation exists between retort life (at any rate, as indicated by severity of flaking) and any of the factors of design or operation. 'No correlation appears to exist between the size of the retort or the type of bricks and the severity of flaking.' Relations do, however, appear to exist 'between the shape of the retort and flaking and between flue systems and flaking.' To the latter Mr. Laming had drawn attention. Here, mention is made of an 'impression . . . that flaking is less severe in retorts of elliptical cross section than in retorts of rectangular section.'

Scurfing practice varied widely over the sixteen works in nearly every detail. The operating engineer tends to arrange scurfing periods to suit demand for gas. 'In the view of the refractories technologist (and probably from an economic point of view) the care of the refractories ought always to be the limiting factor.'

Generally it appears that 'downward scurfing using a chimney and deflector plates and induced draught is practised.' And 'at none of the 16 works visited is there any obvious correlation between the method of scurfing and the severity of flaking.' Neither does the latter bear any obvious relation to procedure for damper adjustment, though at most works some attempt, at any rate, is made to reduce combustion chamber temperatures during scurfing. 'The overall impression is that, if airborne scaling is used *ab initio*, benefits are obtained, but that if leaks have developed it is too late to obtain any improvement by its use.'

The net conclusion is that 'Further

work in the field and in the laboratory is necessary before an ideal procedure (for scurfing) can be evolved.'

Mr. Laming's paper on temperature surveys in continuous vertical retorts is a convenient summary of the work described and the comments made in previous publications. Much of it overlaps the observations of the two previous papers. A fairly long passage on the heating-up of retorts merits careful study. It confirms the recommendations laid down by reputable designers and contractors in this field. And Mr. Laming's observations on conditions during the working period and the several factors influencing working conditions are equally valuable.

Significant differences

Mr. Laming called attention to the fact that the surveys have shown that brickwork temperatures lag as much as 350°C. behind the temperatures indicated by the normal measuring devices which are placed in the gas uptakes and the waste-gas flue. In the period of gaseous firing there may be significant differences of temperature horizontally through the setting so that, particularly in a big retort, the long walls must expand vertically more than unheated end walls, setting up strains in the joints. 'It is probable that the effect of such strains would be to break the bond between the jointing cement and the retort panels and thus provide an easy path for leaks to develop later in retort life.'

An interesting observation is that the surveys showed a remarkably constant temperature gradient in the working period averaged over the whole height of the retort, at between 60° and 64°C. per inch. A rough calculation of the total heat flow into the retort gives 10 to 12 therms per ton of coal, assuming thermal conductivity of the retort wall at 11.0 British units, effective height of the retort 20 to 24 ft. and throughput 1 ton of coal per day per 10 in. of retort major axis. This agrees quite well with Dr. Pexton's assessment, on theoretical grounds, of the amount of heat required for carbonisation at 9.5 therms per ton.

Mr. Laming went on to summarise and comment on the numerous other points arising out of the temperature surveys—the surprising facts concerning the temperature variations on the carbonising face—the effects of throughput and the properties of the coal on temperature conditions—and the relation of the temperature surveys to the investigation on flaking.

The comments of engineers on this subject are of great interest. With regard to heating-up there are several remarks on the importance of the preliminary drying-out of the brickwork. The present technique is briefly summarised by Mr. Cottrell. It has, he says, 'been developed over many years (a) to drive off all the moisture in the brickwork and cement joints with the minimum disturbance, and (b) to overcome the effects of the well-known inversions of silica.'

Several of the contributors referred to Mr. Laming's remark that the temperature of the brickwork of the setting lags behind the temperature of the exit gas, 'by which control is usually exercised,' by some 350°C. Mr. Hamlyn, of the N.W.G.B., reported that at Denton they experimented with the use of hygrometers to assess the dryness of the setting 'since it is probable that the water contained within the refractories contributes considerably to the lag mentioned above.' Mr. Moys, of the W.M.G.B., mentions an interesting suggestion that some additional heat should be applied internally. (We believe that this procedure has been experimented with in one or two cases with some success. Coal gas flames were lighted inside the base of each retort.) All agreed that the drying-out and heating-up of a 'green' bench is an operation of great delicacy demanding the maximum of care and attention.

Comments on retort wall temperatures in the working period were varied and discursive. Several referred to discrepances between thermo-couples and the optical pyrometer. Fluctuations, it was almost unanimously agreed, were attributable to irregular travel of the charge ('the known erratic movement of the coal charge in a theoretically continuous retort'). The N.E.G.B. welcomed the recent introduction of a retort travel alarm as a useful development. It was widely doubted whether the observations of the Report on the effect of throughput and coal on temperature conditions were conclusive.

On temperature surveys in relation to flaking there are several excellent comments. Mr. Hamlyn wrote that any work that would point the way to a reduction of flaking would be appreciated. He did feel, however, that while the operator may be able to contribute something to this end, he could not do everything. It must be borne in mind that the retort cannot be coddled. It must have its working conditions altered to suit gas demands, it must be expected to over-run occasionally the regular scurfing cycle, it must virtually accept any coal it is given, it must often accept rapid coal changes from day to day both in quality and size, and it must accept the hazards of being operated by someone with human failings for every minute of its life. Mr. Cottrell sums up: 'At the moment, it is obvious that . . . there is no easy practical panacea for flaking and the indications are that the problem will remain with us while continuous vertical retorts are built of lime-bonded silica bricks of normal permeability and are required to work at the usually accepted economic outputs.'

The 'Report on Refractories in Oil-gas Plants' is a preliminary investigation of conditions and performance in three catalytic oil-gas plants in use in this country which are briefly described. In these plants the conditions to which the bricks are subjected are so severe as to make the life of common refractories uneconomically short.

This preliminary Report attempts to assess the problems. It does not offer solutions to them, 'but merely puts on record the types of deterioration that occur frequently and shows what has been done on the plants to overcome failures in refractories and in the laboratory to assess the reasons for failure.'

In 'Progress Report of Other Investigations,' among the more interesting is that on the comparative performance of French silica and British siliceous CVR material. The two materials were built in 1952 into two adjacent settings in a works in the North Eastern area.

Observations and measurements after partial demolition indicate that, in this works, 'flaking of the French silica is more severe than the flaking in adjacent retorts with siliceous material in the flaking zone. It is not claimed that this would always be so, but it appears to indicate that French silica is not the answer to every flaking problem.'

DISCUSSION

Mr. J. Laming (Pickford, Holland & Co., Ltd.): Most of my remarks are concerned with Section V, containing the comments of several gas engineers on the review of work on temperatures in gas retorts.

(1) *Heating Up:* The temperature surveys showed that, during heating up, the side walls of the retort heat more rapidly than the retort ends and that in consequence the side walls could be above the cristobalite inversion point when the retort ends were below the inversion temperature. This led to a suggestion that differential expansion of side walls and end walls could break the bond between jointing cement and brick, and might thus provide an easy path for leaks to develop later in retort life. Mr. A. F. Cottrell has said that no difference in expansion can be detected by direct measurement between long walls and end walls. This is not surprising, since bonded silicon brickwork will not deform at retort temperatures and the end walls will therefore be carried up with the long walls. Indeed, the fact that no difference in expansion can be detected between long walls and end walls is itself an indication that joints near the end walls must have been broken.

Again, Mr. Cottrell has argued that differential expansion would be more pronounced towards the top, and that leaks should therefore be more common at the top of the retort than at the bottom. However, as noted above, this would not be the case in bonded rigid brickwork. The widest gaps would occur where the horizontal temperature difference was greatest. Furthermore, leaks are unlikely to occur in regions where carbon is deposited on the retort walls. The levels where leaks are common are those where scurf is scanty or absent.

One contributor has suggested that retorts might be redesigned so that horizontal temperature gradients during heating-up could not occur. I remember that the 'tightest' retorts I ever saw during my wanderings round gasworks were of a design, now obsolete, that

allowed the heating gases to circulate all round the retort walls, including the ends. Though working temperatures were normal, no leaks had developed in ten years' working.

(2) *The Working Period:* There was general agreement among contributors that temperature variations during the working period are caused by irregular coal travel. An additional cause mentioned by some was that cavities are formed in the charge. I think that cavity formation is probably an important factor in causing temperature variation.

Several contributors have criticised the lack of detailed information on coals carbonised. Looking back, I must agree that this criticism is fully justified, and that the surveys could have been more valuable if this information had been obtained. In extenuation, I must remind the Institution that the surveys were planned from the viewpoint of the refractories technologist. It was not originally intended to do more than discover the temperature conditions in retorts. When the records were examined it was realised that they contained much information on the physics of carbonisation, but by that time much of the additional data that could have been gathered was no longer available. I would suggest that further surveys should be carried out by the staffs of the area boards who could design them to yield the maximum of information on the carbonising process.

Thermocouple readings

Practically all contributors commented on the difference between thermocouple and optical pyrometer readings, and two contributors have expressed doubts as to the accuracy of the thermocouple readings. I feel, therefore, that some comment on the subject is called for. I shall deal first with the accuracy of the thermocouple readings. The main sources of error are as follows:

(a) Calibration errors.—The initial differences of thermocouple E.M.F.s from the published data are small. At retort temperatures they are certainly less than +2°C.

(b) Thermocouple deterioration. — During the surveys, couples were calibrated each month. When the error exceeded 10°C. at the working temperature, the couple was scrapped and replaced with a new one. Errors of up to 10°C. were allowed for in the published data.

(c) Recorder errors.—The recorder used was of the electronic potentiometer types. Its scale accuracy was better than ±2°C. at any reading; its calibration did not change during the surveys. On this type of instrument, errors due to changes in the electrical resistance of thermocouples and extension leads do not occur.

(d) Thermal conduction along the thermocouple wires and sheaths.—This possibility was investigated in the course of temperature surveys in ships' boilers. Using similar sheaths and couples, the error due to conduction at retort temperatures was less than 5°C. It should be noted that conduction errors in a gas retort are positive (i.e., tend to give a high reading).

All these sources of error were discussed in the original papers, and it was concluded that the maximum possible error was +5° to −10°C. at any point. Errors in temperature gradient would be considerably smaller.

Optical pyrometers are subject to a number of errors, the magnitude of which cannot be easily determined. Some of them are noted below:

(a) Emissitivity. Optical pyrometers are usually calibrated for black-body conditions. Such conditions never obtain in the flues of a retort setting.

(b) Calibration errors. Most gasworks pyrometers are calibrated at infrequent intervals yet change in calibration can be rapid.

(c) Errors due to flame. Flame is present in the lower heating flues of horizontally heated retort settings. It is noteworthy that differences between optical pyrometer and thermocouple readings were large in the lower flues, small in the upper flues.

(d) Operator errors. Tests in several countries have shown that the type of pyrometer commonly used for temperature measurement in gasworks can give quite large operator errors. Under ideal conditions matching errors by a single operator can be as great as 10°C. Different operators may differ by 20°C. or more. The conditions of temperature measurement in a retort setting are far from ideal.

Again, measurement by optical pyrometer can easily lack in objectivity. The operator knows what the temperature should be and this may subconsciously affect his judgment of when the filament disappears. Errors of this sort can be demonstrated even among trained laboratory staff.

Radiation pyrometers

For obvious reasons I do not suggest that retort operators should abandon their D.F. pyrometers in favour of thermocouples. I would make a plea, however, that the optical pyrometer should be used intelligently and with a knowledge of its errors. Radiation pyrometers have been improved enormously in recent years. I should like to suggest that such instruments could easily be used to control retort settings.

(3) *The Temperature Surveys in Relation to Flaking:* This section of the review gave rise to considerable comment and several contributors have asked questions. Most of these questions are discussed in Item 11 of this Report, and a series of recommendations are given on p. 22. It should be noted that downward scurfing is suggested, not because it is fundamentally better than upward scurfing, but because the latter method can more easily get out of control if not supervised by skilled personnel. One further point arises as the result of Mr. Cottrell's remarks. The laboratory scurf was not soft and loosely adhering. That which produced flaking was indistinguishable from retort carbon. Furthermore, it was found by direct experiment that heat treatment of scurf already formed had little effect on its properties. Soft carbon cannot be converted to hard carbon by heat treatment at retort temperatures.

(4) *Iron Spots:* Several years ago, laboratory work on iron spots in silicon bricks indicated that they do not impair the durability of the refractories. Nevertheless, gas engineers still regard iron spots with great suspicion and are prepared to reject bricks exhibiting them. I should like, therefore, to draw attention to p. 65 of the Report. During an inspection of certain retorts let down for repair, several iron spots were found. In all cases they were standing out from the surface of the refractory. Perhaps a brick of iron spot composition would give good service in a gas retort.

Mr. T. Bispham (Deputy Station Engineer, Nine Elms Works, North Thames Gas Board): In view of the high cost of resetting, the section on flaking is most important, while the survey of scurfing practice also deals with this problem. On p. 41, four factors are mentioned in relation to flaking, three of these referring to the gas-making period and the fourth to scurfing.

Temperature effects

Item 1 suggests that a high average temperature on the coal face of the retort may cause flaking, while item 4 indicates that a high temperature gradient in the retort wall may also give rise to flaking. While I am prepared to admit the logic of these deductions from laboratory investigations which lead up to those conclusions, a high temperature gradient in the retort wall would suggest a low temperature on the coal face, because combustion chamber temperatures may be considered to be at a standard level. It would therefore appear that either a high average temperature or a low average temperature on the coal face of this zone may promote flaking.

It is mentioned in the scurfing survey section that the carbonisation of low rank coal in Scotland is usually associated with little flaking in the refractories. In the North Thames Gas Board, at one works, carbonisation of low rank coals at 50% over normal throughput, giving rise to fairly high calorific value gas, has resulted in good coal travel on an extended scurfing cycle, and very little or no flaking after some 500 days' work.

These conditions would normally be associated with a high temperature gradient in the retort wall.

On p. 38, Section D(1) of this Report, it is stated that with reduced coal throughput only the top section of the retort wall showed a reduced temperature gradient. I doubt if most gas engineers would accept this statement.

If coal throughput is decreased and steam increased to give an unchanged thermal output at a lower calorific value, the coal core is known to rise in the retort and the temperature of the charge on the middle and lower sections also rises, and this surely must result in a lower temperature gradient in the retort wall.

As regards the survey of scurfing practice, the summary suggests that the

method of burning off the scurf appears to have little bearing on flaking from the evidence available.

However, in the Section on temperatures it is shown clearly that during normal scurfing procedure serious temperature rises occur, and it may be that under the right conditions of scurf formation with the mildest of existing methods flaking will occur unless those temperature rises are prevented.

While internal temperatures during gas making are difficult to control, this does not so much apply during scurfing, and in the North Thames Gas Board attempts have been made to reduce the usual temperature rises.

The initial rise of 150°C. which occurs on emptying the retort can be eliminated by closing dampers sufficiently and early enough to reduce the combustion chamber temperatures adjacent to the flaking zone to 950°-1,000°C. by the time the coal slide is closed.

The second rise of a similar order which follows on air admission can be moderated by use of steam. If upward air is used, by partially opening the bottom door, and controlling air flow at the top with a suitably sized dip pipe, steam can be introduced, while overheating of the casting can be avoided by tapping off the gas below the top ironwork level. This rise can be reduced to between 50°-100°C.

The burning time is a function of the rate of air-steam flow and at the present time is almost identical with the time occupied by the normal downward diffusion method used previously, the scurfing loss being about 9%.

Steam can be shut off, and dampers increased to normal settings as soon as the scurf is substantially burnt off the long walls.

It will be of great interest to note whether flaking is significantly reduced by this method of scurfing, and at least if it is not it will be reasonably safe to assume that the actual burning of the scurf is not the primary cause of flaking.

Mr. A. F. Cottrell (Woodall-Duckham Construction Co., Ltd.): The main point emerging from the work is the Committee's indication that the study of scurf and scurf removal is unlikely in itself to lead to a solution of flaking in continuous vertical retorts and their further suggestion that the damage may well be the result of working conditions.

This is almost certainly the right approach and it would seem that there are three pointers to substantiate this theory—location of damage, a comparison between IVCs and CVRs and a comparison between the use of English and Scottish coals.

Plastic zone

As regards location, flaking damage does not occur in the lower zones where a coherent coke column exists and steam is present. It always occurs in the semi-coke or plastic zone where irregular coal travel is probably most pronounced and certainly where the thermal shock brought about by alternate forming and filling of voids and consequent overheating and chilling of the brickwork will be most noticeable.

The extent of this plastic zone and hence the extent of the flaking will vary with the throughput of coal and the calorific value of the gas.

The fact that this area is also the scurf forming area may imply that scurf is the predominant factor, but before accepting this we should first compare the behaviour of IVCs which form scurf in the same relative position.

The majority of IVCs are scurfed in exactly the same way as CVRs, but two or three times as often, and it might be expected, therefore, if scurfing is the cause of the trouble that they would be in a much worse condition than CVRs. But in actual fact, the contrary is the case and flaking never occurs. Does this not, therefore, prove that the breakdown of the CVR brick faces is the result of working conditions?

IVCs are certainly chilled once per charge but there is no irregular travel resulting in voids and alternate overheating and chilling.

Less flaking

At works in Scotland where only Scotch coals are used, there is distinctly less flaking, even allowing that temperatures at some works are on the low side. This is most probably due to the use of coals which travel freely and presumably do not form voids. If this is so, there will be less temperature fluctuations at the retort face and this may explain the lower flaking rate. It is known in support of this theory of less voids that off-take temperatures are lower and more regular with Scotch coals than with English.

It may well be, therefore, that the sequence of events in CVRs is first, weakening, if not actual flaking, of the bricks during working which makes them easy victims for damage when the scurf is being burned off. The weakening, of course, may be initiated by impregnation by a particular form of carbon which is itself changed by the variations in temperature.

But even if this is right, it still does not provide a solution and it may be, therefore, that we shall have to turn our attention to the production of a virtually impermeable brick before our troubles are over.

It is interesting, incidentally, to review briefly the practical developments that have taken place over the last 30 years.

This investigation was put in hand as a matter of some urgency at a time when many vertical retorts were downwardly heated. Such retorts flaked fairly rapidly in a narrow band 2 ft. to 3 ft. wide right at the top of the silica with the result that after three or four years' work they had to be cooled down for repairs in the upper silica zone although they were otherwise in good order.

Since then, however, retort design has been improved, upward heating has become general and a more rigid specification for silica bricks has been enforced. As a result retort life has been extended to six, seven or eight years and even then there is rarely any interference with coal travel, and it is unusual for flaking to cause a retort to be put off for repair.

Thus, although the problem is still with us, it has lost at least its original urgency, which is just as well.

Now this point and the fact that we are still uncertain as to how great or how small a part is played by scurfing, makes one wonder whether the proposal to produce a code of practice for scurfing is not premature.

Section 3 shows that the investigators have gone to a considerable amount of trouble to obtain information relating to scurfing and other operational data, and it would be interesting to know whether the major contractors were consulted. By virtue of their knowledge of a great number of installations working on all types of coals, they should be in a good position to help.

Although on p. 42 the authors say that scurfing is the most probable cause of the damage and on p. 12 they extol the virtues of downward scurfing (which incidentally was originally developed to avoid overheating of top ironwork), they agree on p. 32 that replies to their questionnaire do not substantiate this. The generally accepted view would appear to be that the particular method of removing scurf (provided no tools are used) is immaterial. Upward or downward scurfing with or without steam, with or without reversing arrangements, and whether or not coupled up to a fume plant or air blower, appears to make no difference.

Consequently, one rather wonders whether there is any real need for a code of practice for this operation, at least until it is known whether practical proposals can be incorporated which will mitigate the trouble.

In preparing such a code it must in any case be realised that as a general rule gas engineers want their retorts scurfed as quickly as possible and must usually leave the actual operation in the hands of semi-skilled labour.

Any decision to reduce temperatures during scurfing may make the cure worse than the disease as, apart from further loss of gas-making time, it may so reduce the temperature of some of the brickwork that damage other than flaking could result.

Changes of volume

In Section 4, referring to initial heating of settings, we have to remember that the structure consists of a great number of brick shapes of various materials joined together with refractory cements and supported externally by steel bracings. When such a structure is heated up it not only undergoes the normal expansions but the silica work is subjected to a series of physico-chemical changes involving changes of volume and setting up tremendous forces which have to be accommodated.

It is surprising, therefore, that practically all settings, after attaining their full temperatures of 1,350°C. or so, are leak-free, and I suggest that this is proof of a relatively satisfactory heating up tech-

nique. The heating up period of six weeks has been adopted to ensure adequate soaking time for the whole mass of brickwork and in most cases it permits red heat conditions well up in the retort before proceeding to gaseous firing.

Leakage is certainly the usual reason for shutting settings down but as a general rule this does not become a matter of any seriousness until the retorts have been working for three or four years. In view of this, it seems doubtful if disruption of the brickwork during initial heating is the prime cause of the trouble, and this is perhaps substantiated by the fact that leaks occur in both upwardly and downwardly heated retorts in the same zone despite the difference in the position of the high temperature zone.

The working conditions in a retort setting are arduous and continuous and I am often surprised at the excellent conditions of a large percentage of the brickwork and the jointing after seven or eight years' work. I firmly believe that the damage is attributable to these working conditions and that initial heating, if carried out under proper supervision, plays only a minor part in the matter.

Mr. J. F. Clements (in a brief reply): Mr. Bispham remarked about the disappearing filament optical pyrometer and said that it was unlikely that large errors would arise suddenly without being detected. In our experience they can in fact arise almost within a few days and be of the order, as he pointed out, of 30°C., or even more. We have found from our optical pyrometers in the laboratory that they can suddenly develop errors of 30° and 40°C. over a week or possibly less, and since calibration intervals are usually much longer than that, one can be very seriously caught out.

Regarding Mr. Bispham's remarks on flaking, Mr. Laming's theory of the association of a steep temperature gradient in the flaking zone with the severe flaking was based on quite extensive observations and on laboratory experiments, and I think we will cling to that theory until it is disproved. It may be unlikely on practical grounds from the practical man's point of view, but it is based on quite firm knowedge of what is going on in that impregnated layer.

Mr. Bisphams' description of his method of scurfing, using dip pipes, is very interesting indeed, particularly since it was obviously producing a new kind of scurfing in which the scurf was capable of being burned. That, if Mr. Wylde's theory of flaking is correct, would have an immense effect on flaking itself. Wylde's theory supposes that flakes are actually pulled off the face of the brickwork by the scurf during scurfing. If Mr. Bispham has devised a method of avoiding that, it is going to cure flaking. If Mr. Wylde is correct and flaking still continues, we shall have a little more evidence on the two theories.

GAS EDUCATION COMMITTEE

Sandwich courses playing more prominent part in training gas engineers

DR. A. E. HAFFNER, presenting the Report of the Gas Education Committee, said that throughout the year the Institution had continued to collaborate with the Gas Council in connection with education, and liaison had been maintained between the appropriate committees.

Further Christmas lectures were delivered last year, and it was now estimated that during the seven years they had been run nearly 9,000 young people had attended them in different parts of the country. Most prominent among the lecturers had been Mr. Frank Brinsley, who by now had lectured to over 6,000 school children; not everyone could be aware of the difficult journeys he had undertaken during inclement weather to produce at each place a polished performance which had instructed and amused so many young people.

Now that he had retired from active work in the gas industry, he had placed his experience at the disposal of others who might wish to undertake this strenuous but rewarding work.

District Education Committees and Sections of the Institution could, perhaps, organise lectures in different parts of the country so that Mr. Brinsley's good work could through others be continued and extended.

The value of Christmas lectures could be assessed in a number of ways. To the lecturer, strenuous though the preparations were, it was singularly rewarding to capture the response of keen young people. Some of those young people might be attracted to serve in the gas industry, and those who did not, would think the better of the gas industry either as consumers or as servants of other industries.

Speaking of a short course for teachers in gas fitting arranged by the Ministry of Education, Dr. Haffner said: 'For the first time I have been able to appreciate directly the value of these courses because I was invited to spend a day at one and realised the special value of their residential character whereby the students could sharpen their wits on each other.

'These courses for teachers have been confined to gas fitting, and a testimony to their value is to be found in repeated suggestions that there should be similar courses for teachers in gas engineering. It is believed that the Ministry of Education is devoting some thought to this but it cannot be expected to be immediately possible.'

Sandwich courses in gas engineering were now being conducted at the Royal Technical College, Salford, the College of Technology, Birmingham, and the Westminster Technical College, while a sandwich course in civil engineering, which could be adapted in the final year to gas engineering, was being conducted at Enfield Technical College.

Sandwich courses were playing a prominent part in training gas engineers, but a realistic review of the probable rate of recruitment of technical people into the gas industry made it clear that the existing four colleges were sufficient without being tempted to initiate still another sandwich course in any other college.

Considerable thought had been given to the need to modify the Associate Membership examination, to take into account the separation of gas engineering activities into three streams, namely, gas manufacture, gas distribution and gas utilisation, instead of two streams, gas manufacture and gas supply, which was the present basis.

The Education Committee had now unanimously accepted the report of an ad hoc committee charged with the task of revising syllabuses to bring about this new division, and in turn the Education Committee had unanimously agreed that the report should be submitted to the Council of the Institution. The Council of the Institution had still to give their final views upon it, but it could be said that all the educational aspects were expected to receive full approval, but the impact of those changes upon the different forms of membership had still to be closely studied by the Council of the Institution.

It was expected that the Associate Membership examination would be amended to provide for specialisation in three streams without, however, sacrificing some basic knowledge in all of them.

Much of the internal gas engineering training in the gas industry was carried on through sandwich courses, and it was likely that this increased specialisation would lead to an extension of the present three year sandwich course to four years.

At the moment young engineers in the industry were trained under the Associate Membership examination, many via the National Certificate routes. The numbers

so trained were diminishing. This was not unexpected when the relative advantages of sandwich courses were considered. The Salford course had averaged an intake of more than 30 students over the past four years, while the Birmingham College of Technology had enrolled about ten each year in the last three years. This tendency was expected to increase, fewer taking the Associate Membership examination and more taking internal sandwich course examinations.

Mr. J. H. Dyde, Deputy Chairman, Eastern Gas Board, spoke about the National Council for Technological Awards and the Diploma in Technology (see Editorial Comment).

Mr. W. R. Branson, Deputy Chairman of the West Midlands Gas Board, said that with the imminent termination of National Service and the bulge in school leavers now was the time when active steps should be taken to introduce sandwich courses of four years' duration leading to the Hives or Dip. Tech. award.

Encouraging feature

Mr. L. F. Randall, Commercial Manager of the East Midlands Gas Board, and Chairman of the Sales Training Committee, said the encouraging feature of the Report was that 123 candidates—the highest number since the inception of the Certificate in Gas Salesmanship and Consumer Service—had sat for the written examinations this year. Whether, in a comparative sense, this was a satisfactory number was very much open to conjecture. It might be regarded as a disappointing figure out of a total strength of 136,000 employees.

It might also be asked, now the industry was beginning to realise it must sell first and manufacture afterwards, whether this number of candidates, even if it increased year by year, would be adequate to meet demand.

The curriculum had been looked at closely to be certain that the course as it stood met with today's requirements. It was reassuring that the Commercial Managers' Committee of the Gas Council considered that this was so. But it was pointed out, said Mr. Randall, that one of the main difficulties faced by district personnel was to find sufficient time to devote to and to qualify in, the ancillary subjects. Any examination in a major subject must be adequately backed by a knowledge of all the ancillary subjects which supported it.

Unbalanced

Mr. Randall said: 'In spite of this apparent difficulty it is hoped that all boards will give increasing support to their staff sitting for the Certificate because, while it is recognised that most boards now find it necessary to have their own sales training courses, these are mostly of an intensive nature and are concentrated mainly on the subject of selling, and are therefore somewhat unbalanced.

'Is it not very much better for any employee who is attracted towards the practice of salesmanship and consumer service to be encouraged to make the personal effort to study under the Institution's Education Scheme and thereby demonstrate that he has the latent ability?'

One matter which the Sales Training Committee considered and which required emphasising, was the fact that many candidates each year gave up after a short while. It was felt that to some measure this might be due to the fact that in the regulations the first year was devoted entirely to ancillary subjects and the main subject of Gas Technology (Supply) was not commenced until the second year.

The regulations, however, pointed out that it was not essential for the subjects contained in the course to be studied in any particular order; while it was obviously desirable for the ancillary subjects to precede the main subjects of Technology and Salesmanship.

'While, from the academic viewpoint, the opinion expressed cannot be challenged, the Committee suggest that if the study of the principal subjects could be included as part of the curriculum for the first year, this procedure would perhaps sustain interest during what is obviously the most critical period of any course extending beyond the one year.'

Mr. N. Ankers, North Western Gas Board, as one of the students to be chosen to attend the first sandwich course held at the Royal Technical College, Salford, gave his views on what he considered was 'a most excellent scheme.'

Thorough grounding

There were two main streams of candidates for the course, namely, employees of gas boards who had qualified by part time study to Ordinary National Certificate level, and secondary school students holding a General Certificate of Education at advanced level. 'I belonged to the former category and I believe this method is ideal in its present form. In my own case I worked at a small works with an output of less than 3 mill. cu.ft. per day. I feel that experience in a works of this size offers a thorough grounding in every aspect and department of gas production.'

Mr. Ankers went on: 'Since nationalisation, however, the number of small works has decreased yearly, and without careful supervision of practical training it would be easy for a junior technical assistant to be lost in one department of a large works such as the laboratory or the retort house.

'In the North Western Gas Board's scheme an apprentice spends his first two years following a detailed practical training programme, which takes him into each department of the Board—not only production, distribution and industrial, but also sales and service, transport and accountancy. During this period an apprentice studies on a part-time basis for his Ordinary National Certificate.

'This form of training produces a broad-minded student, due to the fact that he has experienced "what the other fellow does" by working in his department. I feel that having worked in all departments I understand my colleagues' problems more clearly and I can appreciate their points of view. This leads to greatly improved co-operation.

'Another advantage of having worked in other departments is that an apprentice knows sufficient of the work of the departments to enable him to make the best choice for his future career.

'For the next three years the sandwich course is undertaken and in this, six-monthly periods of full-time academic training alternate with planned six-monthly periods of specialised training in the particular section of the industry chosen by the apprentice for his future career. In my own opinion, the training obtained in a small works has been greatly improved by this scheme.

Academically qualified

'The students holding a General Certificate of Education are academically qualified to enter the sandwich course immediately they leave school and join the industry. So that they are not handicapped, the scheme provides for a one-year period of general training prior to entering this course. The sandwich course then, by its very nature, ensures a broad practical training which, in my opinion, is so valuable. The strain of part-time study up to the old higher grade standard is, I have no doubt, appreciated by all of you who have suffered and sacrificed under that method. I shudder to think what my student life would have been but for the sandwich course—"All work and no play makes Jack a dull boy."

'The course offers a balanced life with results which I believe speak for themselves. Full-time college life is, as it should be, a combination of working hard and playing hard.'

The sandwich course offered a 'fast lane' to the final qualification of the Institution. A student now reached his destination sooner, even though his route was the same. Surely, it was better for the young technical assistant to be equipped early in his career to deal with all his responsibilities.

Mr. Ankers concluded: 'The gas industry has become a very technical one requiring many qualified technicians. The control and use made of these technicians has become most important. I think the sandwich course gives this control, because a board has a known number of students located in particular parts of its area, and it knows that each of them will reach a minimum standard of academic and practical training.'

Five-year sandwich?

Mr. J. Maitland-Edwards, H.M. Inspector, said that a three-year sandwich course had two terms per year, giving six terms total in college. The university degree course had three terms a year for three years, giving a total of nine. 'Therefore, your students are at the moment receiving only two-thirds of the university education time in college. It is a matter of simple arithmetic. One more year full time or two further years' sandwich would balance. On the other hand, you are surprised at the thought of a possible five-year sandwich course. There are in existence some five-year sandwich courses from the same standards of admission as university entrance.'

GAS COUNCIL RESEARCH SCHOLARSHIPS

'Sound background for other work'

Mr. W. K. Hutchison describes four 1955 reports now completed

MR. W. K. HUTCHISON, Chairman of the South Eastern Gas Board, introducing the Report on the Gas Council Research Scholarships, said that those who examined the three yearly Reports which had been produced would appreciate that, while the work might not be of immediate significance to the engineer in his daily task, many of the subjects covered were of the utmost importance to the provision of a sound background for other research work which may develop therefrom.

The subjects covered might be said to fall into two or three classes. There had been straight chemical engineering investigations, such as the investigation into the mechanism of loading in packed towers, a study of the condensation of vapours in the presence of non-condensable gases, and work on the effect of induced pulsations on forced convection heat transfer.

Direct bearing

'These studies,' said Mr. Hutchison, 'May well have a direct bearing on further improvements in our processes of purification and the general handling of gases. It is interesting to find that there has been for three years a continuous study of a very interesting piece of background work for the industry, the equilibrium between carbon dioxide, hydrogen sulphide and sodium carbonate and other alkaline solutions, at varying pressures. The important work for our future development is that done at a pressure of 20 atm. The paper dealing with that subject should have been included in this Report, but it was not ready in time and will have to be carried over to next year.

'There is another category of work which is closely related to the other main function of gas, which is to burn. It is undoubtedly true that after 120 years we know only just a little more about the nature of flame than we did when we first lit the gas made all those years ago. This is a very involved subject, and it is only now, as I see it, being resolved in terms of straight chemistry and straight physics.

Complementary

'The work which has been done at universities on this subject seems to me to be fully complementary to the equally important or more important work which is being done at Leeds and the many applications of the principles which are being and will be more and more developed in the application of gas in industry and in the home.

'There is another class of work which is perhaps of less immediate importance to our industry, namely the more or less fundamental investigations which are carried out from time to time. I think we can agree that there is a good dividend to be obtained there in the greater knowledge of fundamental chemical and physical processes developed in such work.

'Perhaps only in one respect we have not had the success for which we might have hoped: I do not think that any research scholar has yet joined the industry, though I may be wrong about that. We hoped that the effect of these scholarships would be to interest people in our industry, and that in due course promising university graduates would be sufficiently interested to wish to work in our laboratories. Taking a broad view, however, we can claim that the scheme has been successful not only in helping an important national objective, that of research in the universities, but in identifying the gas industry with that objective.

'I now turn to the presentation of the work of these scholars. The work of the five scholars who were awarded scholarships in 1955 has now been completed, although in one instance, as I have already said, the report is not yet ready. We have therefore in this report the abstracts of four theses which are available at the offices of the Gas Council. I have read them and can assure research workers that there is much material in them which it is well worth their while to look at.'

Deals with gallium

'The first report is on the work of Miss M. Loft, working under Professor Sir Cyril Hinshelwood at Oxford. This is an extraordinarily interesting report, because it deals with gallium. Many works have in the past made great efforts to increase the production of the related metal germanium, which has a high commercial value and a high commercial importance in connection with electronic devices. It is extremely interesting to see that Miss Loft, going into the whole subject most carefully, has detected a possible method whereby gallium survives in the dust from producers, whereas it does not survive in other parts of the carbonising plant where we might have expected it.

'The solution put forward, that the gallium survives temporarily as a nitride, which is volatile but some of which survives the high temperature long enough to be carried into the flues by the rapid flow of gas and is then burned to form the sesquioxide, may well be the clue which we missed when trying to find why no improvement seemed to be possible in the yield of germanium in existing processes. This work, as those of us who have been in the industry for some years will remember, goes back to the fundamental work of Sir Gilbert Morgan in 1933.

Fundamental research

'Mr. J. S. Davidson, working in Glasgow under Professor Robertson, has carried out research work of a type which perhaps appears to be less directly concerned with our work as gas engineers. It falls into the category of basic, fundamental research into the problems of photomutarotation. That subject may perhaps not appear to be of immediate significance, but it may have a bearing on some of the fundamental data which have made possible the exciting and interesting new methods of gas analysis of which we heard this morning.

'Mr. J. A. Sage held his scholarship at the University of London under Professor Newitt and made a study of the measurement of homogeneous ignition temperatures. I need not emphasise the importance of such a subject to an industry the interests of which in ignition and combustion are always fundamental and far-reaching.

'Mr. G. W. R. Shallis, working in the University of London under Professor Donald, studied the effects of major variables on the heights of small laminar diffusion flames. It will be apparent that work of this sort has a very close relation to the work being done at Leeds on a similar subject. It is hardly necessary for me to deal with the findings of this work, but we shall be happy to leave it to those who are continuing research into the nature of flames to absorb these conclusions into their thinking and benefit thereby.

Not finished

'Mr. D. K. Morris's work at Birmingham under Professor Garner is not yet finished, as I have already mentioned, and the account of it must be held over until next year. It is concerned, as I said, with the basic data which affect the purification of gas under high pressure.'

CHAIRMEN'S TECHNICAL COMMITTEE

Dr. Burns talks of the work undertaken on behalf of the industry

DR. J. BURNS, Chairman of the Chairmen's Technical Committee, presented the 19th Report of this Committee. He said the day-to-day work carried out by the Institution's technical committees was among the most important undertaken by the Institution on behalf of the industry.

The work of the Codes of Practice Sub-Committee under the Chairmanship of Mr. J. E. Davis, for example, set down in the most precise form the best method of carrying out many day-to-day operations in the industry. It might be mundane work but it was important.

Then there was the Gas Distribution Committee under the Chairmanship of Mr. Atkin. The work of this Committee was becoming more and more important.

In the last few years there had been almost a revolution in the carriage of materials associated with the gas industry. Until a few years ago it had been economical to carry coal and raw materials to the point of manufacture. With developments in gas distribution and transmission techniques, it was now more important to carry the industry's products than the raw materials.

Good results

This Committee worked in close relationship with the contractors who supplied distribution materials. There was a happy tie-up between the contractors and the men working on distribution which was leading to very good results.

There was also the Gasworks Effluent Committee under the Chairmanship of Mr. George Diamond, Chairman of the West Midlands Gas Board. With ever-increasing industrialisation, the authorities in this country were beginning to call a halt to air pollution and effluent problems, and would continue to do so.

Under the direction of Mr. Diamond, the Committee was carrying out very useful work, especially in association with the Technical Committees of the Gas Council.

Then there was the Gasworks Safety Rules Committee under the Chairmanship of Mr. Battersby. More and more, industry demanded—and was required to ensure—that the operating and safety conditions of its operatives should be good.

The Committee has learned from the industry generally, and passed on the lessons to everybody. If nothing else, it saved money and anxious moments in the courts.

Then there was the Meters Committee under the Chairmanship of Mr. Horsefall. it was becoming more important to the industry to be completely accurate in the measurements of these products.

There was very happy collaboration between the Meters Committee, the users of the meters and the contractors who made the meters for the industry. This mutual work would benefit the industry.

There was also the curiously named *Ad Hoc* Committee on Electrical Bonding. Through the work of this Committee more and more had come to be known about this subject to the benefit of the industry.

Mr. G. le B. Diamond, Chairman, West Midlands Gas Board, said The Gasworks Effluent Committee, jointly with the Gas Council, presented comprehensive evidence to the Armer Committee in the early part of the year.

Among other things, attention was drawn to the fact that area gas boards, unlike other industries, were liable for the payment of rates without any de-rating benefit. That meant that the gas industry was paying more in rates to the local authority than the de-rated industries. This ought to be taken into account in formulating charges for the reception of trade effluent.

The gas industry was in a unique position in that area boards were prohibited by reason of paragraph 32 of the Third Schedule to the Gas Act, 1948, from causing or permitting to be brought to or flow into any river or stream waste product or other substance produced in the making or supplying of gas. The offence thus created might be committed by the discharge of such an innocuous waste product.

The Armer Committee had been urged to suggest in their report a repeal of this enactment. It was not generally realised what a menace this enactment was if a large gas manufacturing plant were established in a locality where there were no means of discharging effluent into the sewers of a local authority.

Lords appeal

Mention was also made in the report to the Chairman's Technical Committee of the petition against the Birmingham Bill. There could be little doubt that, but for the staunch support of the Federation of British Industries and I.C.I., they might have been landed with a most inequitable piece of legislation. The day was won only by an appeal to the Lords.

In this case an attempt was made to institute a system of charge based upon a new formula founded on assumptions that 25% of the cost of disposal related to sedimentation, 50% for oxidisation and 25% for sludge treatment. There was also a suggestion of imposing a charge for the conveyance of sewage.

Much highly technical evidence was prepared and presented to Counsel, the gist of which set out to prove that the time had not yet arrived when the effect of the known gas liquor constituents on sewage purification could be predicted with accuracy.

In the end the unsatisfactory formula was withdrawn and an agreed clause was allowed by the Committee. Moreover, a full right of appeal to the Minister of Housing and Local Government was secured.

Never in the history of the industry had so much work been going on at the same time on the problem of the disposal of effluent. The work of Mr. Badger had already been alluded to, but there was a large volume of research work being prosecuted in other parts of the country, particularly at Leeds University.

Contrived

Recently an extensive research project was inaugurated by the Birmingham Tame and Rea District Drainage Board, which was being financed jointly by the West Midlands Gas Board and the Drainage Authority. It comprised a long term dosage under carefully controlled conditions of what amounted to 48 model sewage disposal works, each unit being equipped with a detritus tank, a biological filter and a humus tank. The dosage of the effluent and the changeover cycle was operated by pneumatic gear which had been specially contrived for the purpose.

The disposal of effluent was a tiresome business that did not earn anything and cost money. If the industry were compelled to put in large scale treatment plant it could well tip the economic balance against the Lurgi process. Already at the Avenue coke-oven plant, where the local authority sewage disposal works could not accept the effluent, the cost of treatment had been given as 39s. per 1,000 gal. despite the credit arising from the tar acids.

Mr. F. L. Atkin, Chairman of the Gas Distribution Committee, said the work of the Gas Distribution Committee mentioned on pages 9-12 of the 19th Report summarised another year of great activity. Distribution engineering might not be spectacular or glamorous, but there must be some importance attached to a section of the industry which spent up to £20 mill. a year on the laying of over 2,000 miles of mains and .25 mill. new services.

When this section of the industry hit the headlines it was usually unwanted publicity, and because of this the containing of lethal gas was uppermost in the minds of all distributing engineers. It was not surprising, therefore, to find that the work of the Committee was very much concerned with the breakage of cast iron mains, the improvement to

service pipe wrappings and leakage surveys.

In addition to the standard form for the reporting of broken mains, a further form had been devised for reporting incidents to persons and properties arising from broken mains. This had the approval of the Institution Council and the Gas Council, and the Distribution Committee trusted that all members of the Institution would co-operate in their compilation and which would be critically studied by the Committee.

Another frequent cause of gas leakage was corroded service pipes, and the Committee were examining the existing methods of protection and exploring new methods. The Committee were very grateful for the co-operation of the steel pipe manufacturers and the makers of the various types of pipe protection whose collaboration had been most valuable.

Somewhat slow progress had been made since the Panel were awaiting the formulation of a suitable coal tar enamel; this was now available, and pipes had been coated, and it was hoped that the results of the tests would be available very soon.

Interim reports on the method of performing leakage surveys by small hole drilling and the use of an explosimeter were very encouraging, and it was quite clear that this method had come to stay. The results must, however, be interpreted with discretion, and while the saving in loss of gas was important, this was secondary to the anticipation of dangerous circumstances.

Must be acknowledged

A document concerning 'Recommendations for the Maintenance of Gas Governors Used for Distribution' would be available shortly. The importance of safe and satisfactory governing must be acknowledged.

Mr. T. C. Battersby, Eastern Gas Board, said that the Chief Inspector of Factories reported that last year in gasworks there were 3.054 lost time accidents, 12 fatal accidents, and several incidents involving damage to plant. As scientific knowledge increased and new processes were introduced, the hazards of operation were not likely to decrease.

Accordingly, in addition to recommendations drafted as a result of operating experiences, every effort was made by the Committee to keep abreast of new development. From time to time it drew upon the working knowledge of kindred industries and was greatly helped by H.M. Factory Inspectorate.

During the year, the small panel appointed to consider a revision of the Code of Practice for the Safe Design and Operation of Gas Boosting and Exhausting Plant completed its work, and the scope of the recommendation had been expanded as implied in the title.

In a document such as this, it was not possible to lay down precise recommendations for the operation and maintenance of all the types of plant that might be installed but typical examples were given of operating instructions and the procedure which should be adopted whenever repairs of a major nature were contemplated.

In anticipation of the hazards associated with the gasification of light petroleum distillates, considerable time and thought had been given to the preparation of safety recommendations covering the storage and use of this feed stock. In this work the Committee had had the assistance of the manufacturers of gasification plants and had consulted the Chief Inspector of Factories and the Chief Inspector, Explosions Branch, Home Office. The Recommendations had now been published.

Recently, doubt had been thrown upon the position of stills, fractionating columns, dissociators and preheaters in relation to the examination required under Section 30 of the Factories Act, 1937. The Chief Inspector of Factories had now agreed that, subject to certain conditions, these vessels may be regarded as steam containers to which periodic thorough examinations do not apply.

It had been drawn to the notice of the Committee that there was some variation in the interpretation of the factory regulations in respect to instruments with gas and electric connections and the Committee felt that it was unnecessarily onerous to suggest that all instruments, wherever installed, should either be mechanically driven or be connected with intrinsically safe circuits.

After discussion with the Senior Electrical Inspector, it had been agreed to recommend that instruments installed in dangerous zones should either be mechanically driven or have intrinsically safe electrical circuits, but outside these zones such instruments might be fitted with normal electrical equipment if the top of the case incorporated an explosion relief and the front of the case was glazed with wired glass.

With a view to bringing this to the notice of instrument makers, talks were now proceeding with representatives of the British Industrial Measuring and Control Apparatus Manufacturers.

The Committee was now reviewing accidents and fatalities in coal hoppers. These incidents were not peculiar to the gas industry. The Central Electricity Board had deemed it necessary to draw up a comprehensive series of safety rules covering work in and over coal and ash bunkers, and had very generously given the Institution permission to reproduce in any safety recommendations they might make, sections of the Electricity Board's regulations relevant to gas industry practice.

Possible hazards

The report of the Ad Hoc Committee on Electrical Bonding was now being considered by the Gas Council. The investigations had shown that the possible hazards arising from electrical short-circuits were gas leakage, fire, explosion or shock.

Hitherto, the recommendations of both the Institution of Gas Engineers and the Institution of Electrical Engineers had been designed to achieve a method of installation which would give complete segregation of their respective services but in practice this was rarely attained and a very different situation existed.

A number of earth resistance tests in all kinds of premises showed that the existence of an isolated gas service was probably less than one in 20.

While it was not possible to obtain precise information as to the number of fires attributable to sparking between electricity and gas supply systems, it would appear that every year between 20 and 60 fires in each area gas board were due to an electrical short-circuit.

The majority of fires resulted from the melting of lead or composition pipe and, less frequently, the perforation of meter cases. Most short-circuits arose from fortuitous contact between a gas pipe and an electric conduit carrying fault current or defective cabling.

Accordingly, the Committee was unanimous in concluding that however desirable the segregation of gas, water and electricity services might be, in practice it was rarely capable of being achieved.

In view of the hazard which existed, the Committee recommended that a continuity bond should be established whenever a gas service pipe, an installation pipe, a cathodically protected pipe or a wrapped gas main was to be severed.

Bonding together

The Committee also considered it desirable to seek agreement with the public utilities concerned that the electrical industry should adopt the practice of bonding together electricity, gas and water services in premises whether or not they are all electrically continuous, provided that in all cases the electricity supply system was independently and effectively earthed.

Mr. A. V. Horsfall, Commercial Manager, West Midlands Gas Board, said that at the first meetings of the reconstituted Meters Committee members quickly became aware of the scope arising from the terms of reference. Many separate items were submitted for investigation, any one of which might well occupy the Committee for a long time ahead. The difficulty, therefore, was to decide which subject most deserved early consideration. It had been agreed that the domestic meter should have priority.

The Committee would concern itself with technical matters only and not attempt to judge commercial issues arising therefrom, since that would impinge upon the functions of other committees.

Generally speaking the domestic meter functioned with remarkable accuracy and was probably the only item of domestic equipment subject to statutory test before installation and required to maintain that test performance standard of accuracy over many years of useful life with minimum servicing attention.

This did not mean, however, that meters had reached perfection. They continued to break down in service from various causes. It was with this in mind that area boards were asked to supply detailed answers to a meter fault questionnaire covering the July/September quarter this year. Completed questionnaires were now coming to hand and

will be subject to the most careful analysis.

The Committee was also concerned with what was expected of a domestic meter, the relation between capacity and case size and the frequency distribution of consumption rates in average household service conditions.

There were at present four sizes of domestic meter. If the frequency of consumption rates at loads varying from ignition pilots to large water heater rates of gas flow per hour could be determined, it might be possible for the domestic field to be covered by a more limited range at capacities most suitable to meet increased consumption rates and avoid replacement when additional appliances are installed.

A Sub-Committee was investigating how best to obtain information on consumption frequencies and it was possible that area boards would again be approached for their assistance in this matter.

Rationalising capacities

Other matters under investigation concerned a reappraisal of industrial meter sizes with a view to rationalising capacities in more uniform steps, the issue of conversion tables to determine the capacity at which a meter could operate for gases of lower specific gravity than air as distinct from the meter badged capacity and what effect, if any, the passage of stray electric current might have upon a meter.

Mr. Eric D. Rose, Chief Engineer, Eastern Gas Board, said he wished to speak on the memorandum on installations for the use of light petroleum distillates in low pressure gasification plants as the Eastern Gas Board had this year completed two installations in connection with the use of light distillate on c.w.g. plants.

It was well that the memorandum started by emphasising the necessity of full consultation with the Factory Department of the Ministry of Labour, the local authority and the Customs and Excise Department. It was also useful to include the representatives of the petroleum company undertaking supply. Much useful assistance could be obtained from all these bodies and it was essential that all should be satisfied.

There was no hard and fast regulation published by any of these bodies so that the memorandum represented the first published document setting out all the points to be covered to maintain an adequate standard of safety.

It had been thought that underground storage might be unduly expensive on account of the smaller sizes of tanks involved and the necessity of providing separate pumps to each tank, any connection between tanks at invert level being obviously out of the question.

In one of the installations he had mentioned tanks of 27,000 gal. capacity had been employed, and were delivered to site completely fabricated. In a future installation now being planned the underground tanks would each be of 67,000 gal. capacity and although these could be delivered in one piece fabrication on site was proving less costly. Pumping from such underground tanks presented little difficulty as excellent submersible pumps of American design but British manufacture were obtainable. With this type of pump a low level cut out was necessary to avoid overheating by running dry.

The venting of storage tanks to a positive pressure gas system was an advantage the gas industry had over most other users. The greatest care should be taken in the selection of the gas main to which connection was to be made. It should be one which is never normally shut off.

Even then the system should be protected, suitable notices calling attention to the connection placed against any valves controlling the main in question, so that in the event of closure the connection could be switched to an alternative vent. It was necessary to protect the storage against venting into a closed main and to protect an apparently closed main against the ingress of inflammable vapour.

The Report prepared by the Ad Hoc Committee on Electrical Bonding was an excellent document. The recommendation of the first paragraph covering the use of temporary continuity bonds during severance of pipe systems was a reasonable and desirable safety precaution that could be adopted at any time without the intervention of an outside authority.

But the second recommendation dealing with cross bonding was one that would not only require negotiation between all authorities concerned at top level but would also demand co-operation at operational level.

We could not make connection to an electrical system without the permission of the electrical undertaker. It would be useless to do so without the sure knowledge from the electrical undertaker that the bond was being connected to a true 'earth' on the electrical system.

Gas, water, and electricity undertakers must each agree on site that bonds were properly connected to proper and suitable points on their respective systems.

Mr. David Beavis, Scottish Gas Board, said there had been anxiety in recent years as to whether we were replacing our mains and services at a sufficient tempo or whether there was not a general ageing of our distribution systems with a day of technical and financial reckoning that would not be deferred for ever.

Leakage survey

Age alone was not the determining factor in pipeline condition. The leakage survey could be our method of diagnosis of pipeline condition. It was to be hoped the committees would guide us to a prudent but not over-costly programme of replacement.

Careful thought was needed in the programming of leakage surveys and the techniques adopted. His Division was meeting a lack of enthusiasm by highway engineers for the puncturing at such frequent intervals of road surfaces and anxiety for the safety of other underground services.

It was to be hoped that as a result of the Panel's study of this subject an authoritative lead would be given on the best methods technically and economically to conduct this work in a fashion acceptable to other authorities interested in highways and the services buried under them.

A recent survey of a small district with a large unaccounted-for gas figure had established that faults on the distribution system were by far the greatest contribution to the cause. All mains and services were the subject of leakage survey by probe and explosimeter and faults were detected and remedied. Although the survey and subsequent repairs cost some £800, the reduction in unaccounted-for gas would repay this expenditure in less than two years.

Before indulging in extensive and expensive survey work it might be cheaper to isolate districts temporarily and conduct over-night tests of gas consumption with a view to determining unaccounted-for gas. An acceptable figure for unaccounted-for gas should not be difficult to establish, and intensive survey would then, in the first instance at any rate, be conducted only in those areas which exceeded the figure.

In this way leakage surveys might pay for themselves, a considerable attraction in the present period of financial stringency.

It was a matter of regret and puzzlement in Scotland that the application of the Street Works Act (Code of Practice) was so far confined to England and Wales.

Mr. L. W. Andrew, Manager, Watson House, said meters were the scape-goats for unaccounted-for gas. They were expected to operate accurately at a range of, say, 2,000 to one on any gas put through them; in addition, nobody wanted them.

Two major problems

But everybody had to have them. So they were always with us. He therefore welcomed the Meters Committee.

He agreed with the Committee that the design of meters was on the whole good, and they were doing a difficult job remarkably well. But the two major problems which affected metering and to which work should be directed must be remembered.

The first was the total overall cost of metering as a service, and whether it could be brought down. The second, whether there was anything which could be done to maintain the most effective registration of the very small stand-by rates which were becoming increasingly common, for example, the small pilots on cookers.

The Watson House Centre and the London Research Station had the responsibility for testing and approving meters, their development and the research work on them. To further that work, at the specific request of the Board about two years ago, they were urgently requested to form a Watson House Centre Meters Committee.

That was in formation, and through that Committee and the direct contact between the laboratories of the meter manufacturers of the S.B.G.I. and also

the contact with the Consultative Committee of the commercial managers and the S.B.G.I., they were operating at the Watson House Centre now on very similar lines and pattern to those used on normal domestic appliances.

The relation of the Centre to the I.G.E. Meters Committee might appear complicated, but it was not. The Report of the Chairmen's Technical Committee showed that a very adequate safeguard was provided. The problem was recognised, and there was a remarkable degree of common membership between the Watson House Centre Technical Committee, its Meters Committee and the I.G.E. Meters Committee.

Mr. H. Johnston, speaking to that part of the Report under the heading 'Gasworks Safety Rules Committee,' and 'Ad Hoc Committee on Electrical Bonding' said the Safety Rules Committee had carried out a great deal of essential work embodying recommendations brought to their notice through the medium of print in general circulation.

These rules were appreciated by management and men alike. It was also satisfactory to realise that H.M. Inspectors and others were evidencing an increasing awareness of the work of the Institution in matters of safety.

Regional levels

Mention was made in the Report of the approval and welcome of the safety recommendations for the safe use of light petroleum distillate in oil gasification plants by H.M. Chief Inspectors of Factories and of the Explosives Branch of the Home Office. This approval extended down the line to regional levels, which was helpful to those who had to consult with them.

Despite the thought given to safety matters by the Safety Rules Committee, forthcoming eventually as recommendations, this could not be the end of the matter. There remained the practical application involving the human element.

It was not enough to design and install, often at considerable expense, plant and equipment to safety specifications, if operatives were not given an awareness of purpose, and if operations were not carried out with common sense and appreciation of circumstances peculiar to that operation and outside any printed rules.

A sense of responsibility must be imparted to employees. Much was being done by the use of safety officers and education, but the use of care and thoughtful application must be extended as much as possible. Nothing led to accidents so much as lack of interest, or ignorance of the men doing the job.

It was sometimes said that rules were made to be broken. Nevertheless, the word rule conveyed a meaning of rigidness and inflexibility. The Committee paid great attention to the framing of the recommendations, to lay down fundamentals in design and operation, and avoid as far as possible exacting detail, realising that often there is more than one way of carrying out an established principle.

For these reasons, there might be advantages in altering the title to 'The Gasworks Safety Codes Committee,' better conveying intentions to the man on the works by removing the implied exactness of the word rule.

The 'Memorandum on installations for the use of light petroleum distillates' reproduced as Supplement 2 to the Reports had, in view of the large quantities of light distillate rather quickly made available and the quick action taken to adapt plants for its use, already proved to be valuable.

The hazards of using a low-flash distillate were apparent from the commencement. This gave concern not only to plant engineers, and designers, but also to factory and other inspectors, who required to be satisfied of safety and soundness.

The London Chief Inspectors, who had been brought into consultation by the Gasworks Safety Rules Committee, appreciated the position and were helpful. The one difficulty was to satisfy the City Fire Officers that venting of storage tanks to a positive gas system, instead of to the atmosphere, was sound and safe.

Finally, a word on the work of the 'Ad Hoc Committee on Electrical Bonding.' In 1952 he had submitted a memorandum to the Safety Rules Committee in connection with a central heating boiler fitted with a solenoid valve control on the gas supply. The electricity authorities were not satisfied with the earth provided and wished to make additions of a copper bridge connection from inlet to outlet meter, and also provide an additional earth wire taken from the service pipe on the inlet to the meter, coupled at the other end to their own equipment.

The Committee at that time concluded that it was generally desirable to keep gas and electric services apart, insulating if necessary, but that this was often not possible and that in such conditions it was safer to crossbond. It was also suggested that in this particular case the regulations of the I.E.E. be applied, but that this be done without prejudice to any recommendations on whether or not to bond, which the I.G.E. might wish to make at a later date.

Since that time considerable evidence of cases and hazards had been brought forward, leading to the appointment of the Ad Hoc Committee on Electrical Bonding to consider the problems arising from the flowing of electric currents in gas installations. The Ad Hoc Committee had now put forward positive recommendations.

It was clear that before the recommendations could be uniformly practised, steps would have to be taken to obtain agreement with the electric and water authorities. There might be conflicting opinion within the electrical industry itself on these matters, and to get an agreed concerted policy would be a real achievement.

To implement the recommendations would entail more thought on formulating methods and standards, agreements on responsibilities for effective bonding, earthing, etc., and would occasion additional expense. On the other hand hazards on fire, explosion and electric shock were very real, and to reduce such risks to life and property, was nothing but commendable.

Watson House chief to give this year's Christmas lecture on gas

THE eighth Christmas lecture for young people to be held under the ægis of the Institution of Gas Engineers, will be given in the main chemistry lecture hall of the Royal College of Science in Imperial Institute Road on January 2, 1959, at 2.30 p.m. The lecturer will be Mr. L. W. Andrew, and the title, 'Harnessing the Flame.'

This lecture will consider the best use of the various types of flame discussed in previous lectures. Practical demonstrations will cover heat outputs of individual flames of a range of several thousands to one. It is hoped to use coloured slides to demonstrate the use of larger flames.

The problem will be considered initially in terms of familiar scientific principles and then in terms of present-day and future applications to home and industry. The following aspects will be covered:—

Introduction and scope, range of flames under discussion and the basic problem which is to be solved; production of the right sort of flame, with special reference to ignition and burner design; the use of flames for the production of light, heat and power—the problem of heat transfer will be considered for the direct and indirect application of the flame; production and dispersal of products of combustion; modern methods of controlling flames and ensuring the fullest use of their inherent flexibility including the use of electronic control; and future developments.

Overtime ban lifted

Maintenance men at Derwenthaugh coke works, Co. Durham, have lifted a ban on overtime imposed following a dispute with the Coal Board over the working of a 42-hour week. It had been reported that they intended to tender notices terminating their employment as a result of the dispute.

Complaint lodged

Hebburn (Co. Durham) Urban Council has complained to the Durham Divisional Coal Board regarding the emission of smoke and fumes from the Monkton coke works which adjoin a Council housing estate.

Prospective development—and the present situation—of gas in the U.S.S.R.

By M. SIDORENKO

THE gas industry of the U.S.S.R., one of the youngest branches, is developing rapidly and acquiring greater and greater importance from year to year.

Before 1917 the gas industry in our country was at a very low level. Several cities of Russia had small-size gas plants which manufactured insignificant quantities of gas, mainly for lighting streets and railway stations. In 1913 only 17 mill. cu. metres of gas were produced. Natural gas was not produced at all in the pre-revolutionary Russia. Casing-head gas was neither collected nor utilised.

The production of gas began to grow rapidly in 1956. Between 1945 and 1950 the average annual increase in gas output amounted to about 500 mill. cu. metres, and between 1950 and 1955 it just exceeded 600 mill. cu. metres, but the increase in gas production in 1957 alone was 6,500 mill. cu. metres.

The network of gas mains was also insignificant until just recently. In 1950 the length of the country's gas mains totalled only 2,300 km., which is about as much as was put into operation in 1957 alone.

Abrupt rise

Taking into account the known gas reserves and the necessity of introducing more oil and gas as economical types of fuel into the country's fuel balance, a resolution was passed recently providing for an abrupt rise in the rate of development of the natural gas industry and its transformation in a short period into one of the leading branches of the national economy of the U.S.S.R. Fulfilment of this great task will call for a considerable increase in the industrial gas reserves, rapid growth of the production of natural and casing-head gases, extension of the gas main network, the provision of gas to a large number of towns and villages, the transference of a number of large industrial enterprises to gaseous fuel, and the utilisation of considerable quantities of natural gas as chemical raw materials.

Until recently very little prospecting for natural gas deposits was done in the Soviet Union. In the pre-war period comparatively small resources of natural gas of the industrial categories were discovered in the Komi A.S.S.R., in the vicinity of the city of Buguruslan, Orenburg region, and in the north of the Caucasus.

In 1942, gas prospecting was started in the Saratov and Stalingrad regions, and this work gave positive results. In the years immediately following the second world war several deposits were discovered in West Ukraine, making it possible to supply gas to the Ukrainian capital, Kiev. Increased prospecting work in the post-war period resulted also in the discovery of the North Stavropol natural gas deposit, one of the largest in our country.

Until not long ago, however, prospecting specially for gas deposits was conducted only in regions adjacent to those where gas deposits had been discovered previously. In all other regions gas prospecting was carried on only in conjunction with oil prospecting. Under such conditions, the growth of the industrial reserves of natural gas was far too slow. It became necessary, therefore, to start special work in gas prospecting. Only in 1956 and 1957 were new gas deposits discovered containing considerable reserves of gas.

Recent intensive gas prospecting and exploration have resulted in the discovery not only of a great number of gas deposits in our country, but of absolutely new gas-bearing regions in East Ukraine, in the Trans-Volga area, in the Krasnodar territory, in West and East Siberia, in Middle Asia, in the Azerbaidjan S.S.R. and so on.

The high rate of development of the gas industry planned for the near future calls for a several-fold rise in the industrial gas resources. In this connection it is planned to increase the industrial resources in the period 1959-65 considerably and to raise the total meterage of exploratory gas drilling to 15 mill.

Twice as high

As indicated earlier, until recently natural gas was produced in the U.S.S.R. in insignificant quantities. Beginning from 1955-56, in connection with the discovery of a number of large deposits the gas output began to grow much more rapidly. By 1956, 12,000 mill. cu. metres of gas were being produced annually, this being almost 1.5 times as much as during the previous year, while in 1957 the gas output was almost twice as high as in 1955.

In accordance with the programme of rapid growth of the gas industry, the production of natural and casing-head gas as well as the production of artificial gas in the U.S.S.R. is to be raised by 1965 to 150,000 mill. cu. metres, the output of natural gas increasing almost sixfold in comparison with 1958, and that of casing-head gas more than 2½ times.

In connection with the starting up of a large number of gas deposits, and to ensure a high technical level of their development, it is planned to complete by 1965 the chief work for all-round automation of Soviet gas fields and to employ advanced methods of intensifying gas production, such as hydraulic fracturing of oil strata, perforation of wells under gas pressure, hydrochloric acid treatment of well bottoms and so on, and to employ joint exploitation of several seams by a single well at multi-seam gas deposits.

Casing-head gas

Of great importance for the national economy is the casing-head gas obtained from oil wells as a by-product. The economic advantages of utilising casing-head gas and the considerable potential resources of this gas determined the necessity of rapidly developing this branch of the gas industry. For this purpose it is planned to raise the production of casing-head gas by 1965 to 15,400 mill. cu. metres per year, compared to 5,500 mill. cu. metres in 1958. Capital investments and technical material resources are being directed primarily towards the collection and utilisation of casing-head gas at deposits having high well capacities, where large resources of this gas are concentrated and where the casing-head gas can be best utilised by the consumers.

Further development of the underground gasification of coal involves extensions of the stations already in operation and completion of the semi-commercial stations under construction, complete mastery of the process and attainment of the full industrial capacities of the stations, as well as intensification of research work. At present underground gas is being produced at operating underground gasification stations. Two more stations are now under construction. The output of underground gas totalled 760 mill. cu. metres in 1958. The draft prospective plan provides for a rise of the gas output to 6,000 mill. cu. metres per year in 1965.

In the more distant future (1970-72) it is planned to raise the yearly gas produc-

An abbreviated paper presented to the 24th Autumn Research Meeting last week

tion to 270,000-320,000 mill. cu. metres. This great increase in gas production will enable a substantial change in the structure of the country's fuel balance. According to preliminary calculations, the share of gas in the fuel balance of the country will increase to 21-23% by 1965.

Long-distance gas delivery began in the Soviet Union in 1946 with the completion of the first gas main, 800 km. long, between Saratov and Moscow. This consisted of 300 mm. pipes. During the second world war several other mains were built, including the Buguruslan-Kuibyshev main, 160 km. long. The growth of the production of natural gas and the construction of mains progressed, especially after the war. In 1948 a 20-in. pipeline, 500 km. long, was put into operation between Dashava and Kiev. In 1951 this gas main was extended to Mosow, 800 km. Thus, the total length of the gas pipeline from the Carpathian deposits to Moscow is over 1,300 km. At the same time the construction of several gas pipelines between Ufa and Kazan for casing-head gas was started, with branches leading to Bugulma, Almetyevsk and other towns. In effect, a uniform gas pipe system has been set up here, ensuring rational utilisation of the resources of casing-head gas of this major oil district. At present the capacity of this system is being increased by the construction of new pipelines and compressor stations; it is also being extended eastwards to Magnitogorsk and westwards to Gorky. In 1954-55 a considerable number of gas pipelines were built to supply gas to consumers in the towns of Stalingrad and many others, and a number of gas pipes were built from the wells to consumers in the nearest towns.

Largest in Europe

In connection with the discovery of large gas deposits in East Ukraine, a pipeline was built in 1955 from the Shebelinsk deposit to the city of Kharkov, and in 1956 from Shebelinsk to Dnepropetrovsk. In 1955 the construction of the Stavropol-Moscow gas main, the largest in Europe, was started. It consists of 720-mm. pipes and is 1,300 km. long. The same year saw the completion of a gas pipe section to the town of Rostov, making it possible to meet the gas demands of that town.

The most intensive period in the construction of the Stavropol-Moscow gas main was 1956, when the first-order unit of the main was put in operation. This made it possible to supply Moscow with Stavropol gas beginning in January, 1957. At present the second line of this main and compressor stations equipped with turbo-compressors having gas turbine and electrical drives is being constructed at forced rates. In the near future, therefore, a complex system of gas pipes between Stavropol and Moscow will be completed. The total length will be about 3,000 km., it will have ten compressor stations and will convey almost 40 mill. cu. metres of gas per 24-hour day. The installed power rating of all the compressor stations along the pipeline will amount to 310,000 kW.

The total length of gas mains in the U.S.S.R. today exceeds 10,000 km. Thus, in the course of the past decade the map of gas mains in the European part of the U.S.S.R. has changed sharply. It is crossed by gas mains both meridionally and latitudinally. Gas mains connect the large industrial centres with the districts where natural gas is produced. The further rapid development of the gas industry involves a considerable extension of the gas pipe network in our country.

Between 1959 and 1965 it is planned to create a potent system of mains to ensure gas supply to the chief economic districts of the European part of the Soviet Union, the Urals and Middle Asia. The mains will pass through the territories of all the 15 Union Republics. Accomplishment of the planned construction of pipelines will enable a radical change to be made in the state of the fuel supply to the most important economic districts of the country. Between 1959 and 1965 it is planned to build and put in operation over 26,000 km. of mains and branches from them to cities, industrial centres and populated localities. Thus, in the course of the next seven years, ten times as many mains will be built as during the period 1950-55, while the total network of mains will increase almost fourfold by 1965 compared with 1957.

In planning the directions for laying out the chief gas mains and determining the amounts of gas to be supplied to the economic districts, account was taken of all the factors characterising the aggregate of conditions and the changes resulting from the use of gas in the development of the productive forces and in the structure of the fuel balance of each economic district. Delivery of gas to the chief economic district of the country will considerably improve the fuel and power balance of these districts and will help to reduce distant fuel deliveries and to lower the cost of the fuel consumed.

Regarding natural gas as one of the most important factors in improving the structure of the country's fuel balance and for saving social labour, the Soviet Government gives special attention to its use for communal and domestic needs.

Before 1917, natural and casing-head gas was employed for domestic purposes in Russia on a far from sufficient scale. In 1913, only 2,700 flats in Moscow were supplied with gas from the gas plants. The total annual output of the gas plants in Petrograd in 1913 amounted to about 30 mill. cu. metres. The growth of the gas output and the construction of a number of gas pipelines started in the post-war period were aimed primarily at providing gas for the communal and domestic services of a number of cities of the U.S.S.R. By 1957 over 520,000 flats, about 900 canteens, 500 medical establishments and over 200 educational institutions were being supplied with gas in Moscow. In Leningrad at present 256,000 flats, 3,100 service enterprises and cultural establishments receive gas. In Kiev 95,500 and in Lvov 72,000 flats are supplied with gas. Altogether, over 180 towns of the Soviet Union were receiving gas in 1957. Over 1.5 mill. flats were provided with gas in the towns and villages, a total population of 14 mill. enjoying the advantages of gas.

Between 1959 and 1965, over 320 towns and other populated localities will be supplied with gas. By 1965 over 42 mill. persons will be using gas. For this purpose it will be necessary to lay about 23,000 km. of municipal gas pipes and to provide gas to 6 mill. flats in new and existing houses.

According to preliminary calculations, in the next seven or eight years all work in supplying cities and the most important industrial and cultural centres of the country located along the natural- and casing-head-gas lines already existing and to be put into operation will be basically completed. In addition, during the same period it will be necessary to ensure a supply of liquid gas to the population of a number of workers' settlements and rural localities. This will make it possible to supply gas by 1965 to about 35% of the entire population of the U.S.S.R. Extensive provision of gas to towns and villages, alongside the development of an immense scale of housing construction in the U.S.S.R., is an important factor in raising the living standard of the people. The use of gas for domestic purposes will free millions of workers from unproductive work.

The huge natural gas deposits and the immense resources of casing-head and refinery gases are the cheapest source of raw materials for development of the production of numerous organic synthesis products. The organisation of a potent source of raw materials for organic synthesis, based on the use of natural and casing-head gases, creates conditions for rapid development of the production of a larger number of valuable chemical products: Synthetic rubber, fertilisers, synthetic detergents, agricultural insecticides, and herbicides, flotation reagents, solvents, and so on, as many initial intermediates are raw materials simultaneously for different synthetic substances.

The use of gas in other branches of industry, particularly metallurgy, the cement and the glass industries, also promises a very high economic effect.

Geometric progression

Mr. L. J. Clark, Development Engineer, N.T.G.B., said he had seen some of the development work going on in the U.S.S.R., just over two years ago, and the scale of the development, particularly in the natural gas industry, was enormous. The figures which Mr. Sidorenko had given indicated the enormous rate of expansion. It meant an almost geometric progression, almost doubling every year. As a technical feat that was extremely fine.

'There is a great deal of very fine work to be seen in fields other than that of natural gas,' said Mr. Clark. 'The coking industries, the gasification of shale and other sources of gas from the petroleum industry are all making their contribution, and the way in which all this is being tackled in the technical sense is truly impressive.

Refractories research and the gas industry

By

A. T. GREEN

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IN 1908, in the age of the horizontal retort, Mr. F. J. Bywater presented the first paper on refractory materials to the Institution of Gas Engineers. Mr. Bywater's paper, and the subsequent discussion, had much to do with the formation of the Refractory Materials Joint Committee of the Institution, which, except for the year 1915, has since presented reports on refractory materials each year.

J. W. Mellor wrote most of the very early papers. He endeavoured to give definition to certain testing methods and was particularly interested in the after-contraction test, the refractoriness-under-load test and the corrosive action of flue dusts on firebricks; Mellor also had much to do with the drafting of the Institution's original specifications for refractory materials, issued in 1910.

Since 1910, this research has been organised by a joint committee of the gas and refractories industries; it has been concerned with the understanding and evaluation of the properties of refractory products and with the development of improved refractories for the gas industry.

Revolution of practice

The early years of the century saw the advent of the continuous vertical retort. The first retorts were constructed of fireclay products, but in 1920 the change-over to the use of either siliceous or silica products began. Their use allowed comparatively high combustion-chamber temperatures, in the region of 1,300° to 1,350°C, with a resulting increase in the efficiency of the operation. Silica and siliceous products played a great part in this revolution of practice, but their development, and the understanding of their behaviour in service, necessitated much research.

By the end of the last century, crystallographers had observed that silica exists in three principal forms—quartz, cristobalite and tridymite. It had also been observed that, when heated, each form converts to a different state of symmetry. However, the results of these early observations were to some extent confusing and conflicting, and it was not until 1913 that the stability relationships of the forms of silica—as a phase equilibrium diagram—were worked out by C. N. Fenner at the Geophysical Laboratory at Washington.

Why silica should be capable of existing in so many crystalline forms remained unknown until the development of X-ray analysis, by W. H. Bragg, provided a means for deducing how atoms are arranged in a crystal. Quartz was one of the first materials to be examined—in 1914; some ten years later, the general atomic structures of cristobalite and tridymite were partially elucidated.

During the period 1922 to 1930, the Institution published a number of research papers on silica bricks, particularly concerned with (*a*) the refractoriness-under-load properties and the use of the under-load test in helping in the control of silica brick manufacture; (*b*) the thermal conductivity and the spalling tendencies of these products; (*c*) certain general features in the use of silica in both horizontal and vertical retorts.

This work laid the foundation of the relationship between the true specific gravity (powder density) and the after-expansion of the product in test. Further, these investigations have since provided a basis for our modern conception of quality control in manufacture. A silica brick with a very low specific gravity could be considered to have an expansile behaviour capable of being controlled in both the heating-up process and the continued use of the retort.

The siliceous product has also played a conspicuous part in the development of the vertical retort. This product is made from quartzitic sands found in certain positions of the Derbyshire Carboniferous limestone. The sand itself contains upwards of 93% of silica and is associated with a siliceous clay containing upwards of 75% of silica. On firing at an adequate temperature, this product matures and forms a rigid matrix. This resulting product shows little after-expansion and is usually non-contractile at retort temperature. While not having the same structural properties at high temperatures as the silica brick, it is certainly stable at carbonising temperatures and tends to form a well-knit vertical retort.

With the growth of the practical appreciation of factors influencing durability, the work on refractory materials for the Refractories Joint Committee and, therefore, for the gas industry, had to be planned to cover the significant properties of these products. In carrying out these plans, Mr. F. H. Clews and Dr. G. R. Rigby played a most important part.

Pore systems

It was clear that a complete evaluation of texture must include a fundamental consideration of the pore systems within bricks, based on the determination of porosity and permeability. At an early stage in the development of this particular outlook, T. F. E. Rhead introduced a simple, but effective, method of photographing a cut and polished surface of a refractory. New methods for the measurement of porosity were subsequently brought into being and an extensive study of the permeability of materials to gases was conceived and carried out by F. H. Clews and A. T. Green.

Permeability

This work made clear the differences between porosity and permeability. It was pointed out that the permeability of a retort may be of importance, first in determining whether or not gas is lost by passage through the retort walls, and secondly in allowing reactive gases or vapours to penetrate behind the working face.

Turning to the second possible effect of the permeability of the retort wall to gases, it was at this time pointed out that, owing to the heterogeneity of the pore system of the refractory, any corroding agent is likely to be trapped within the pores, where, because of the high temperature, conditions for chemical reaction will be favourable; this would be true

24th Autumn Research Meeting—a 'GAS JOURNAL' abstract and discussion

whether the reactant were carried into the pores as a fine dust or as a vapour. It was also emphasised that it is the rate of flow of gas through a refractory, which, in turn, is related to its permeability, that determines the rate at which alkalis, other fluxing compounds, or carbon, are deposited within the pores; from this, it was deduced that a zone rich in fluxes, or carbon, is likely to be formed within the retort wall, but not far removed from the carbonising face.

Analyses of sections cut from samples of used retort material fully confirmed this expectation and led to the important statement that 'the discontinuity thus produced in the structure of the material may well cause a predisposition to flaking and spalling when subjected to the strain of the next scurfing operation.'

Thermal properties

The Research Association, during the past 30 years, has carried out considerable work on the thermal properties of refractories.

Many investigations on the action of gases and vapours on refractories have been reported to the Institution. The manner in which carbon—obtained from the decomposition of carbon monoxide—may be deposited at low temperature (in the region of 450° to 500°C.) within the pores of certain types of firebrick has formed a study that has been particularly fruitful in certain types of industrial operation.

Going hand in hand with this work, the action of hydrocarbons, including coal gas, on refractories has also been studied. It was demonstrated that the temperature at which the deposition of carbon is most marked is higher than is the case with carbon monoxide. With methane, the temperature of maximum attack was found to be 800° to 900°C.

Observations on the action of hydrocarbon gases on refractory materials would seem to the author to have an application, at the present time, in explaining the observed breakdown of refractories in certain oil-cracking plants.

It is evident that alkalis, in the vapour form, must also be present during the carbonisation of coal. With the object of finding some indications of their effect, a comprehensive series of experiments were carried out.

Refractoriness-under-load

From the earliest days, work on the refractoriness-under-load test has intermittently occupied the attention of the Joint Committee. Dr. Mellor reported in 1918 on the effect of load on the refractoriness of firebrick; in 1956, the results of a co-operative examination of the refractoriness-under-load test were reported. Between these dates, covering a period of almost 40 years, a very considerable body of work on this important property has been reported to the Institution. The refractoriness-under-load test is capable of being used as a means for acquiring some insight into the general behaviour of refractories under stress at high temperatures as well as forming a basis for the evaluation of a definite property.

There can be no doubt of the value of a carefully conceived and adequately controlled refractoriness-under-load test, but control at very high temperatures has been found, with the normal apparatus, to be quite difficult. In spite of this, the test is now very near definition for specification purposes.

The endeavour to attain a better appreciation of the manner in which the elastic and viscous properties of ceramic materials vary with temperature has led to greater understanding of the fundamental causes of thermal spalling.

Much of the work of the Research Association has at various times been concerned with the thermal expansion of refractory materials. The peculiarities in the expansile properties of silica have shown the reasons why controlled heating-up schedules should be adopted for all retort systems. Further, the relative expansile properties of many other types of refractories have given some indication of their spalling properties, work that has been reported on a number of occasions to the Institution.

There are two other features of our research programme that can be reviewed, if only briefly; these relate to refractory jointing materials and to insulating refractories. An early survey of commercial jointing cements being used in the carbonising industry revealed wide variation in their behaviour in laboratory tests. It was recognised that many of the demands made on a jointing cement are incompatible; a cement designed to have one desirable property was found to have unsatisfactory features in other directions. Work carried out by the Research Association endeavoured to show how a compromise could best be effected.

Wider appraisal

The research on insulating refractories arose from a request made by the Institution, a year or so before the second world war, that research be carried out with the object of creating a wider appraisal of the properties of high-temperature insulating materials and of developing methods for their production.

Going hand in hand with the laboratory work on properties, the object of which has been to improve and standardise quality, the Research Association has been concerned with many plant investigations. There has been a continuous endeavour to relate the constitution and properties of refractory materials to their durability in gas retorts. This year's report contains summaries of a considerable amount of this work.

In the case of the vertical retort, much definition has been given to the flaking zone and the slagging zone, with a resultant broad appraisal of the troubles of flaking and of slagging. The precise cause of the formation of the flake appears to be associated with the interpenetration of carbon, probably first as a hydrocarbon, into the surface layer of the silica. There is evidence to indicate that the surface layer becomes a material of different properties from the brick itself and that the temperature and, maybe, different thermal properties of the scurf and the brick cause the dislodgement of this surface layer. Much work has indicated that there may be a strong connection between the nature of the coal being carbonised and the flaking incidence. In examinations of vertical retorts in France, comparatively little evidence of flaking was found. A very similar silica material used in this country for the construction of vertical retorts has shown considerable flaking.

Two other features of durability stand out prominently and have, on occasion, received both laboratory and operational attention. One is the trouble concerned with the lower portion of the retort where much slagging can take place, the slag probably being formed both from the inorganic constituents of the coal deposited on the surface and volatile materials attacking the surface, particularly including alkali and iron compounds. Depending upon the nature of the refractory, the surface will be attacked and will form a fusible slag that may be eroded by the coke, but a fair proportion of this will diffuse into the brickwork—because of the high temperatures of the combustion chamber—and form a slag-impregnated refractory brick.

Differential movement

The other important feature of durability is concerned with leakage of gas and holing of the retort. Here again there is evidence to show that the jointing material itself may be contractile, and that the different amount of movement in the different positions of the vertical retort can cause fissures at the cement joint. These factors can cause first a slight leakage that, after a time, shows as burning gas in a combustion chamber. Once this has started, there is definite evidence that the fissure increases in size and can become a hole, and, from the author's experience, it would seem that differential movement in the retort can account for a fair amount of the fissures formed.

In the heating up of the retort, conspicuous differences in temperature causing differential expansion must be reduced to a minimum. The retort must take up its working temperature with the minimum displacement.

During the author's career, considerable improvements in the durability of refractory materials in gas retorts have taken place. At the same time, there have been conspicuous changes in plant design and in gas-making practice, which, in the main, have subjected the materials of construction to heavier duties. With this in mind, A. E. Haffner's comprehensive study entitled 'Length of Life of Refractories in Carbonising Plant in the British Industry,' given to the Sixth International Gas Conference in 1955, is an outstanding contribution.

Improvements in life

The figures given, while indicating a wide range of effective service—particularly with the vertical retort—show clearly the improvements in the life of refractories over the years. This improvement

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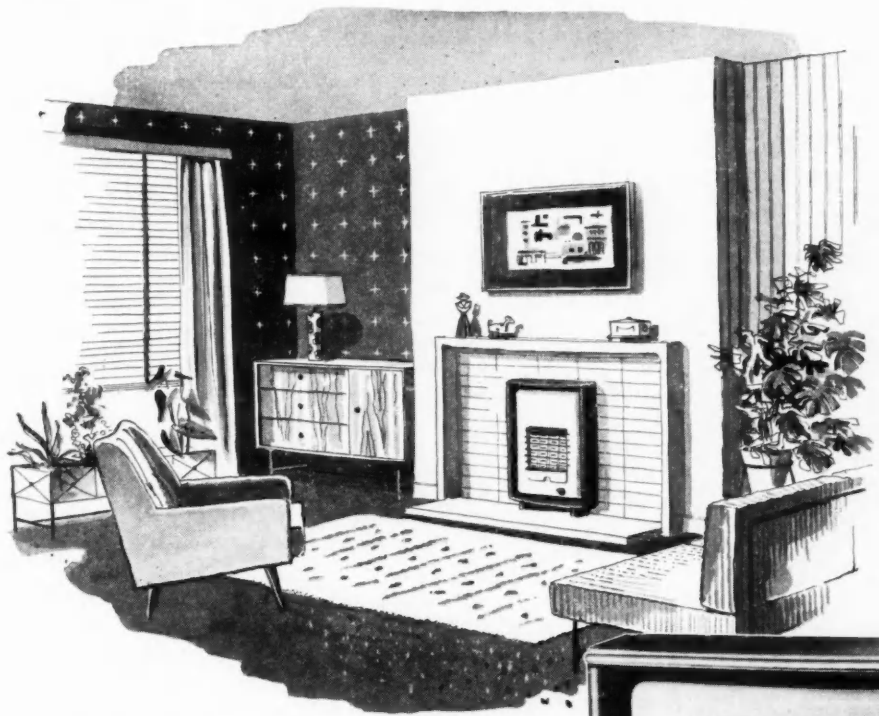

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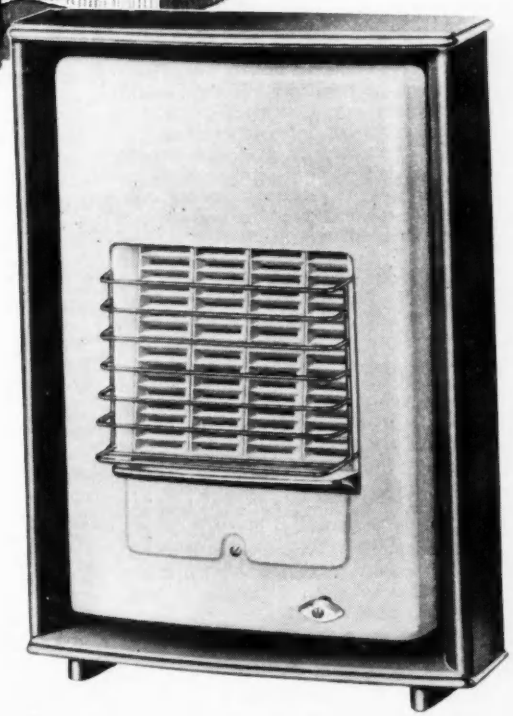

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is due, in large measure, to a greater appreciation of the properties of refractories in relation to both the design and the operation of plants. The effective use of the well converted silica brick is a very good example. The continuation of research and development work on the present lines must now be supplemented by more investigations on the operational factors influencing durability. The present author considers that the temperature surveys can be looked upon as a satisfactory start.

In an Appendix a classified list is given of papers presented to the I.Gas E. by the B.R.R.A. and the B.C.R.A.

DISCUSSION

Mr. T. F. E. Rhead, opening the discussion, appealed to the younger engineers and scientists to have another look at refractories. He said it was a wonderful subject of high temperature chemistry and called for all the resources of chemistry and physics. It was also a wonderful industrial field, including carbonising, metallurgy, and now jet and rocket propulsion.

Mr. Frank West said Dr. Green had done some very valuable research work on the thermal properties and flaking of refractories, on behalf of the gas industry, and it was mainly due to his enthusiasm that gas research had made such progress, progress illustrated by the Report of the Joint Refractories Research Committee.

Professor A. L. Roberts said: Dr. Green's story brought home once again the overriding importance of the refractories in carbonising practice, as well as in other industries. I know that this is a truism and that it applies to every industry dependent upon high-temperature processes; but it is salutary to be reminded of it from time to time. Then there is the main point of his survey: what has been achieved since intensive work on refractories was started—incidentally, not so very long ago—and what has been the impact on the carbonising industries?

He shows how the properties and durability of the refractory affect gas making in so many ways as to make it difficult to establish a single index of progress. We have, of course, Dr. Haffner's valuable figures for the life of refractories in carbonising plant, indicating without question the decided improvements effected in this respect over the last 30 years or so. But these cannot give the whole story; we must include the greater efficiency of plant, the greater control, flexibility and throughput which have come, concurrently, from a better knowledge of the peculiarities of refractories and from practical application of this knowledge in gasmaking and by the manufacturers.

As Dr. Green emphasises, the change-over in 1920 to silica and siliceous materials brought about a revolution in practice and design which ultimately gave us the modern types of carbonising plant with which we are familiar.

In chapter IV, Technological Progress, and especially in chapter V, Durability of Refractory Materials in Gas Retorts, a subject particularly his own, Dr. Green has summarised the tremendous amount of information available about the trials and tribulations that refractories in the service of the gas industry are heir to, information which has accumulated from the intensive work not only within his-Research Association but in the laboratories and from field trials of the industry itself, from the manufacturers and also from the universities. There is a tremendous fund of knowledge and understanding; but, despite this, and probably because of it, there remains much that we do not understand.

This is not just a matter of the difficulties of assessing precisely what is happening in practice, where so often so many factors are operating at the same time that we cannot be sure which of them, if any, is overriding. An obvious example is the problem of flaking, to which Dr. Green has referred in some detail. It is not only that, but also that our fundamental knowledge is incomplete. Dr. Green has rightly emphasised the importance of silica and siliceous materials, which has prompted so much intensive work throughout the world on the mineralogy of this material.

Incidentally, it is interesting to reflect on whether or not this intensive effort would have been made had silica not been of such industrial importance. Despite all the knowledge about what might seem to be a simple material, new facts continue to emerge when new approaches are made to old problems.

I may mention here that when kinetic measurements were recently made of the rate at which quartz transforms into other crystalline forms of silica at high temperatures, a matter which has often been studied, a new feature was brought out, namely that the quartz does not seem to go directly to cristobalite and tridymite, but to an intermediate or temporary phase from which these things are derived. That is a new fact, and one asks why it was not discovered before. I think that the answer is that the techniques for discovering this were not available, and that the progress of research work, particularly nowadays, depends so much on the current development of proper techniques.

This brings me to a main point. As Dr. Green and his colleagues know very well, we are now in an era of solid-state chemistry and physics when it is recognised that the imperfections in solids may be far more important than their perfections, which, in general, do not exist. These concepts, and the new techniques which they necessitate, are of the utmost importance in refractories and ceramic research. It is these lines which future research, particularly with regard to carbonising refractories, will follow. An example is the attention being given to the structure of carbon and scurf.

This has been referred to only to a small extent in the reports to date, but I feel that it will be a really important development in the future, with far-reaching practical repercussions. There is also in the same connection Mr. Laming's interesting suggestion that an interstitial solid solution of carbon in silica, which is quite a new concept, may play a part in scurf formation and consequently in flaking. It seems to me that a new era is being heralded, in research into refractories and ceramics generally.

Dr. A. E. Haffner said: Dr. Green has been good enough to refer to my paper to the International Gas Union on the length of life of refractories, in which I did my best, with limited data collected from various parts of the country, to indicate the improvement expected in retort life. Although the best performances of 20 years ago may be better than the worst still encountered, on an average the expectation of retort life has just about doubled in the last quarter of a century, and the work of Dr. Green and his team has been a major cause of this improvement.

A further programme of work is now planned to remove the remaining problems of flaking, and as the industry turns from coal carbonising there will be new problems to meet, but Dr. Green will leave behind him an organisation ready to tackle these new problems.

The President presented Dr. Green with an inscribed book of signatures from colleagues to mark Dr. Green's forthcoming retirement.

GAS PURIFICATION GROUP MAKES TRADING DEFICIT

A TRADING deficit was made for the year ended June 30 by the Gas Purification and Chemical group of £135,340 (compared with one of £24,136 for the previous 15 months).

In the interim report for the half-year to December 31 the deficit was £130,258, meaning that in the second half of the year trading at a loss had almost ceased. The total loss before tax was £183,840 owing to the Board deeming it prudent to provide for the unsecured loan of £48,500.

Vice-Admiral Sir Charles Hughes Hallett, the Chairman, says considerable progress has been made to get the Company back on a sound footing. During the reorganisation that has taken place since January there have inevitably been some cases where the law permits compensation to be claimed, and the Company will during the current year incur some expenditure on this account.

Long service dinner

At a recent long-service dinner given by George Kent, Ltd., of Luton, over 300 employees with 25 years' service or more were present. Other guests included the Mayor of Luton, Alderman Mrs. F. M. Brash, and Mr. C. W. Salmon, of Cory-Wright & Salmon, Ltd., the Company's Agents in New Zealand. Commander P. W. Kent, the Company's Chairman, presented a number of 25-year and 50-year long-service certificates.

Gas Board gains advantage in fight for Lurgi site

THE latest development in the controversy between the West Midlands Gas Board and the Warwickshire County Council and Meriden Rural District Council on whether a £4½ mill. Lurgi gasification plant should be built at Coleshill indicates that the two councils have lost their fight.

A copy of a letter from the Ministry of Housing to the county authority read at a recent meeting of the Meriden Rural Council stated that there appeared to be no satisfactory alternative to the location.

It added that the site for the plant appeared to be one of two near the town which had both been the subject of unsuccessful planning applications to the County Council by the Board. They are at Gorsey Lane, and an ash tip near Hams Hall power station.

Year ago

A Ministry enquiry into an appeal by the Board against the County Council's refusal of planning permission for the former was held more than a year ago.

An enquiry into a second appeal concerning the ash tip site is to be heard at Coleshill on December 2 and the letter stated that any fresh points advanced would be considered before a final decision was made.

The two councils are strongly against the plan. They have been supported by local parish councils and residents.

The letter stated that the ash tip appeared to be the preferable of the two sites because it was near the power station and outside the green belt. The Gorsey Lane site is inside the green belt.

GAS IN HOUSE NO. 3 MILL.

THE three millionth dwelling to be built since the war was officially handed over to an elderly couple by the Minister of Housing, Mr. Henry Brooke, at Croydon recently. It was a bungalow attached to Dartmouth House, a big new block of flats and maisonettes built by Croydon Borough Council.

There are 44 dwellings altogether in the Dartmouth House scheme, and of these 43 have chosen gas for cooking. Mrs. Jasper—the three millionth housewife—chose a new Kitchenette cooker for her small kitchen.

Dartmouth House has a fully gas equipped communal laundry with an Electrolux washing machine, five gas drying cabinets and two Ascot sink water heaters.

Industrial safety in Birmingham

A RECENT meeting of the Industrial Safety Training Centre operated by the Birmingham and District Industrial Safety Group was attended, among others, by the Chief Inspector of Factories, Mr. T. W. McCullough. At this meeting the 1959 programme was published.

The Centre continues to grow in popularity and no fewer than 66 courses have been arranged for the coming year. These cover all kinds of engineering subjects, as well as courses of interest to the chemical, electrical and building industries. There are also specialist courses for safety engineers, plant engineers, maintenance workers, etc.

A full-time manager is now in charge of the Centre and details of the courses may be obtained on application to 22, Summer Road, Acocks Green, Birmingham.

Change of Address

The London district office of the British Thomson-Houston Co., Ltd. (Manager, Mr. J. L. Dixon), is now at 33, Grosvenor Place, London, S.W.1, and not at Crown House, Aldwych. The British Thomson-Houston Export Co. (Managing Director, Mr. E. V. Small) is already established at the new address. The telephone number is BELgravia 7011.

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LONDON

Sir Ian Horobin, Parliamentary Secretary, Ministry of Power, with the four gas industry recipients, after he had presented them with the British Empire Medal on behalf of the Queen at Lancaster House on November 19. Left to right are Mr. T. Corker, Mr. F. G. James, Sir Ian Horobin, Mr. R. A. Weeks and Mr. E. J. Caudwell.

We must push domestic coke sales, says W.M.G.B. Deputy Chairman

IN view of recent price trends, the gas industry must look to the domestic market as the main outlet for coke sales, said Mr. W. R. Branson, Deputy Chairman of the West Midlands Gas Board, when introducing a coke training course at the Board's training centre at Warwick.

Present high stocks of coke were due to the loss of industrial business, very largely to oil, he continued. The Clean Air Act afforded a great opportunity for the gas industry to advance sales of both gas and coke.

'Progress in setting up smoke control areas is still slow but it will undoubtedly be accelerated if we ensure that the householders in the first areas established get good service from our products. In the case of coke, our problem is to see that the right appliances are correctly installed, that the fuel is of good quality and that prompt delivery of orders is ensured.'

Must learn more

Mr. Branson said there was a danger of sales staff concentrating on the sale of gas appliances to the exclusion of coke and coke burning appliances. Only recently had many showrooms been fitted with live coke stoves. Salesmen must learn more about coke so that they could advise consumers on its use and answer effectively any objections raised.

The two-day course was attended by 18 members of the Board's showroom staff. Other speakers included Mr. E. T. Pickering, Area Chief Chemist, and Mr. D. N. Maddocks, Coke Manager.

BID TO CUT COST OF GAS HEATING IN NOTTS SCHOOLS

AN investigation has been made by Nottinghamshire County Education Committee into the running costs of schools with gas-fired heating systems. It reports that while there is no doubt that the running costs of this type of apparatus are greater than alternative systems used in the county, the capital cost of conversion to other systems such as oil firing would be heavy.

Time set controls

The committee has decided that this question should be deferred for future consideration. It has further decided that time set controls should be installed on the gas-fired heating apparatus at two Mansfield Schools to be selected by the county architect. The estimated expenditure of £400 will be met from the maintenance estimates for the current year.

If the experiment proves successful provision will be made in next year's maintenance estimates for the installation of similar controls at other schools with gas-fired heating systems.

Objection raised

Some members of Reading Town Council are objecting to Southern Gas Board plans for the development of a site adjoining the River Thames immediately west of the River Kennet at Reading.

SIMON-CARVES, LTD. COMPLETES TAKE-OVER DEAL

THE recent offer by Simon-Carves Ltd. to acquire the whole of the issued share capital of Lodge-Cottrell, Ltd., has been accepted by all the shareholders and has become unconditional; arrangements are accordingly being made to complete the transaction.

The cost of acquiring the shares, including stamp duty and other expenses, will amount to approximately £930,000. The consideration is payable wholly in cash which will be found from the Company's liquid resources which are ample for the purpose.

Lodge-Cottrell, Ltd., is a private company with offices and an engineering works in Birmingham. It was the first company to design and install electro-precipitators in Britain, and Simon-Carves, Ltd., became its first British competitor 30 years ago. Between them the two companies have supplied hundreds of plants all over the world to the steel, electricity supply, cement, metallurgical, chemical, and other industries.

It is intended to preserve the name of Lodge-Cottrell, Ltd., and to operate the Company as an independent unit within the Simon-Carves' Group. The present precipitator division of Simon-Carves, Ltd., will continue to operate in this field as at present.

It is believed that the operations of the two organisations will expand in the future to meet the requirements of the Clean Air Act, since electro-precipitation techniques are already widely used for the removal of dust particles from exhaust gases. It is expected that further advantages will ensue from the pooling of research and development facilities.

'Comments on the job'

Problems which trouble factory workers most and may affect their efficiency are suggested by the report of a survey recently undertaken for the National Institute of Industrial Psychology by Dr. Isabel Blain and recently published under the title 'Comments on the Job.'

Northern Juniors see Redheugh Onia Gegi plants

THE Northern Junior Gas Association recently visited the Redheugh works of the Northern Gas Board to see the two Onia Gegi plants, each of 3 mill. cu.ft. capacity per day, which were put into operation not long ago. The visitors were also shown a new water tube boiler, being erected by Clarke Chapman & Co., of 30,000 lb. evaporation per hour.

After tea in the works canteen at the invitation of Mr. W. Sutcliffe, Divisional General Manager, Tyneside Division, Mr. R. S. Longhurst, Carlisle, President of the Northern Juniors, welcomed members and thanked Mr. Sutcliffe for providing the opportunity of visiting the works. Mr. Harry Waiton proposed a vote of thanks to Mr. Sutcliffe.

Mr. Sutcliffe replied, and Mr. J. G. Rutherford, President, East of Scotland Juniors, members of which were also present, thanked Mr. Sutcliffe on behalf of himself and his party.